

# Gypsum Industries

A LITTLE GOES A LONG WAY

Gypsum Industries is part of the Saint-Gobain group, a world leader in engineered materials, which employs over 200,000 people throughout the world.

Gypsum Industries mine gypsum from a deposit in Co. Monaghan. From this raw material, they manufacture a range of plaster and plaster-board products at their production plant in Kingscourt, Co Cavan.

In 2007, Gypsum made some little changes that went a long way in reducing the amount of energy used at their Kingscourt plant.

At the plant, five grinding mills are used to produce the powder used in Gypsum's plaster products. Each of these mills uses a fan; for the production process, the rate of air flow delivered from these fans must be variable.

In the past, the flow rate was varied by running the fans at full capacity and throttling the air flow, using dampers. The new system uses variable speed drives (VSDs) on the fans to provide the correct flow rate, resulting in significant savings in:

<b>Energy</b>	2,120 MWh per annum
<b>CO<sub>2</sub> emissions</b>	1,300 tonnes per annum
<b>Noise pollution</b>	3.5 dBA

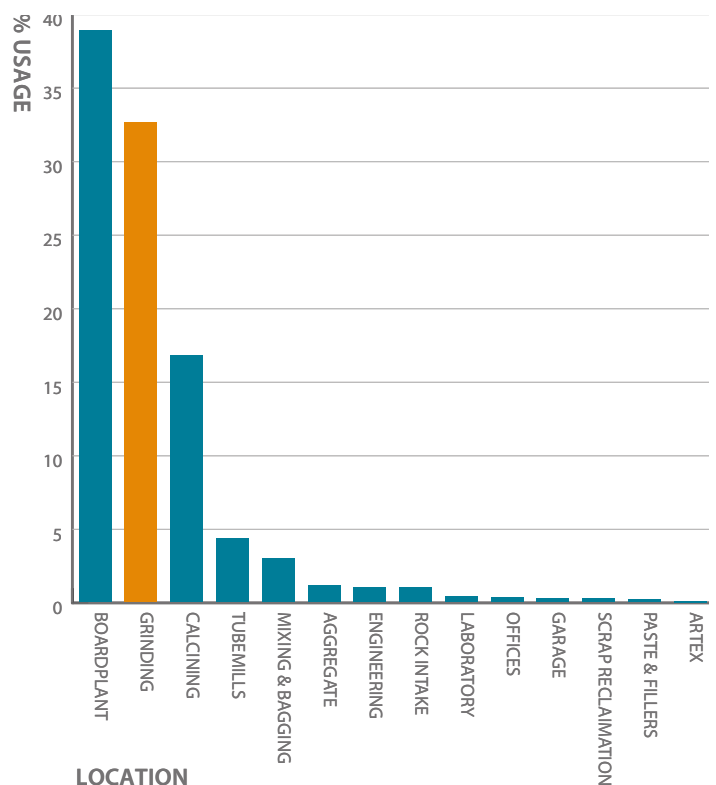
## INVESTIGATING ELECTRICITY USAGE

In early 2007, the World-Class Manufacturing Steering Committee at Gypsum completed an investigation into the amount of electricity being used at the Kingscourt site, following a significant increase in the cost per unit.

The heaviest users of electricity are the Boardplant, Grinding and Calcining areas (see Pareto chart above). The Boardplant has evolved rapidly in recent times. Much has been invested in order to develop what is now considered within the Saint-Gobain group as best practice in production and energy-efficient technology. Equipment in the Boardplant operates within a continuous process; this makes retrofit projects difficult and less practical to schedule. In contrast, the Grinding process, the next heaviest usage area, has machinery that operates independently and is over 50 years old. It was thought, therefore, that in the Grinding area it would be easier to schedule around production demands and achieve significant energy savings. It was decided to focus activity in this process area.

## Electrical Energy Usage By Area Pareto (2006)

Pareto chart showing electricity usage by area at the Kingscourt site



## THE INITIAL SETUP

The Grinding area operates five vertical roller mills, four of which are older Raymond mills, while the fifth is a newer Alstrom mill.

Of the Raymond mills, two have 70 kW fans, and two have 90 kW fans. The Alstrom mill has a 250 kW fan operating at 180 kW. The fans all run at their design speed of 1,480 RPM. Each runs at full capacity and dampers are used to regulate the air flow.

The older Raymond mills all pre-dated the development of VSD technology. VSD was considered in the newer Alstrom mill, but, in discussions with the manufacturer, it was concluded that the machine could not be controlled without the modulating throttling damper at that time.

## THE TECHNICAL DETAILS

The outlet damper controls the output pressure by placing a restriction in the way of the flow, with the motor still running at full speed. By contrast, the VSD varies the speed of the motor and only uses the energy needed to achieve the required output.

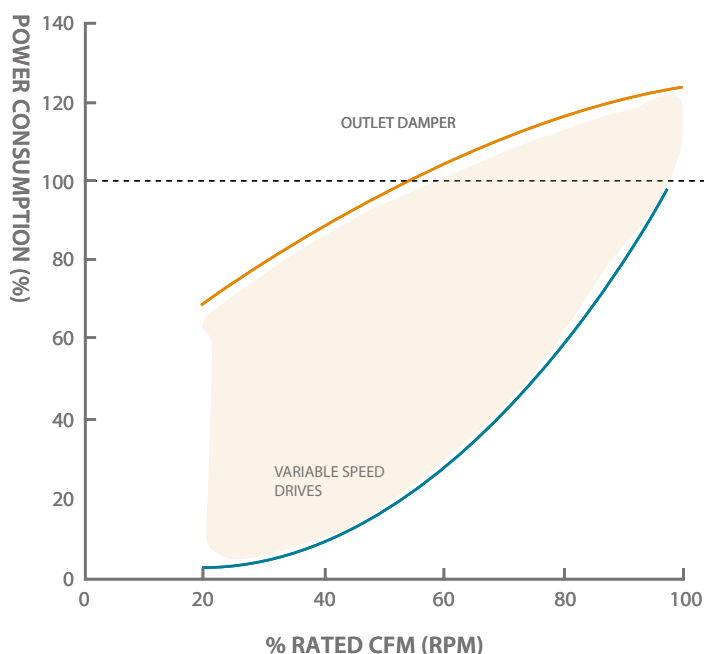
For a change in the fan speed on the new VSDs:

- air flow changes linearly with fan speed;
- air pressure increases as a quadratic function of fan speed;
- power increases as a cube of fan speed.

Based on the above, it was calculated that replacing the dampers with VSDs would result in a reduction of power of approximately 35%.

The graph below shows the energy use of a fan system with two different control methods: outlet dampers and VSDs. It is clear that using VSDs is by far the most efficient solution.

### Energy use of fan system with two different control methods



## THE TRIAL

In April 2007, the engineers at Kingscourt decided to run a trial using a VSD instead of the throttling dampers on one of the 90 kW Raymond mills. Each machine operates as a standalone system; the VSD is controlled using differential air-pressure measurement in the mill to adjust the speed accordingly. Data was collected, based on runtime and readings from an existing meter for the Raymond mills. This meter measures the total power used by the entire mill (i.e. main drive, main fan, ID fan, feeder, centrifuge, etc). The engineers monitored the results on a monthly basis.

The VSD controls the speed of the motor to match the load imposed on it under varying process and environmental conditions. As power consumption is proportional to the cube of the motor speed, significant savings can be achieved. Although several industrial applications can benefit from inverter control, the most significant savings can be made with centrifugal loads such as fans and pumps.

## THE RESULTS – BIG SAVINGS

### Energy savings

The tests showed that energy usage before the VSD installation by the entire mill was 122 kW. After installing the VSD and fully opening the throttling damper, the Raymond mill ran at 77 kW, a saving of 45 kW – and an annual saving of 266 MWh. Gypsum will realise a saving of 2120 MWh per annum across the five grinding mills being retrofitted.

### Noise reduction

Another positive outcome of this retrofit was a reduction in the noise output from the throttling dampers and the fans (because they are now running at lower speeds). Noise levels before the installation peaked at 91 dBA; after the installation, noise peaked at 87.5 dBA, a drop of 3.5 dBA. As the decibel scale is logarithmic, this actually results in a drop in noise power of a factor of 2.24. This is a significant reduction in a location that is classified as a high-noise area.

### CO<sub>2</sub> reduction

The energy saving retrofit expanded across all five mills is calculated at 2,120 MWh per annum. This equates to a CO<sub>2</sub> saving of 1,300 tonnes. That's 1,300 tonnes less greenhouse gas in the environment every year. Quite a return for such a little change.

### Smooth start-up

The retrofit leads to another benefit: the new VSDs allow for a very smooth start-up curve. This is significant because, in the past, excessively high starting currents were experienced, which caused high-tension circuit breakers to trip. When this happens, the kettles automatically dump their entire product, resulting in considerable losses – and time lost in restarting the mills.

## COSTS RECOUPED IN JUST THREE MONTHS

This retrofit project was part-funded under SEI's Industrial Best Practice Initiative. The annual saving in electricity of 2,120 MWh means that Gypsum will have recouped the cost of their investment in just three months. *(All calculations based on 2007 electricity prices.)*

## GOOD FOR GYPSUM AND THE ENVIRONMENT

With a relatively minor investment in time and money, Gypsum Industries have realised significant savings.

The project has created a good-practice demonstration for the group and is being implemented on six machines in the USA and one in Spain.

This case is a prime example of the use of best available technology. An encouraging aspect of this project is that the retrofit is relatively straightforward and can be readily transferred to other sites where damper throttles are used to vary air flow.

*"We were pleasantly surprised at how closely the actual savings mirrored the estimated savings."*

Adrian Kelly,  
Electrical Engineer,  
Gypsum Industries

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