



*We need equipment that we can rely on, and we need to know that if it should go wrong, skilled local service engineers will fix the problem quickly.*

*Florin Bernea, Technical Director at Carpatcement.*

Source: HeidelbergCement

# Energy Savings for Limestone Conveyors

**Location:**

Deva, Romania

**Segment:**

Material Handling

**Problem:**

Worn-out drive systems on limestone transport conveyors

**Solution:**

Eaton MV switchgear, SPI/SPA variable speed drives

**Results:**

Large improvements in reliability and control, big energy savings

**Contact Information**

Mircea Bogdan Balan  
Automation Sales Manager  
mirceabbalan@eaton.com

Christian Buecker  
Manager Trade Press  
christianbuecker@eaton.com

**Background**

Carpatcement Holding SA is a member of the Heidelberg Cement Group which, with 52,000 employees in 40 countries and revenue in excess of €14,000 million in 2012, is one of the world's largest manufacturers of building materials. Carpatcement has 870 employees in Romania, and is the country's leading manufacturer of cement. It operates three plants in the country, at Bicz, Fieni and Deva, which between them generate a turnover of approximately €180 million.

The plant in Deva began operating in 1976, and was taken over by Carpatcement in 2000. It has a licensed production capacity of 1.65 million tons of cement per year.

At this plant – and at all of its other plants – Carpatcement is committed to minimising the environmental impact of its operations. In line with this commitment, the company has

invested €11.7 million in environmental protection measures at Deva.

**Challenges**

An essential part of the cement manufacturing process at the Carpatcement plant in Deva is the transport of limestone from the quarry to the manufacturing plant itself. This is achieved using five conveyor belts that range in length from 1,000 to 1,850 metres. Three of the belts are sharply inclined, as they transport limestone from a quarry high on the side of hill adjacent to the plant, while the remaining two conveyors are substantially level. All of the conveyors must be capable of smooth and controlled starting and stopping, even when they are fully loaded.

Until recently, the conveyors were driven by 250 kW motors operating at 6 kV, but these were operated by fixed speed starters that provided only very basic control. The motors had

also reached the end of their reliable working lives, as had the 6 kV switchgear used to control them. The decision was therefore taken to replace the motors and to fit drives that would offer enhanced control and would perform reliably in the tough operating conditions that are unavoidably associated with cement manufacturing plants.

Additionally, in line with Carpatcement's commitment to protecting the environment, the new drive solution was also required to deliver the best possible energy efficiency.

**Solution**

Carpatcement approached Eaton for help with this project on the basis of the excellent past experience the company had had with Eaton products and with its support services in Romania. Working in close cooperation with the Carpatcement team, Eaton's engineers devised a solution



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based on replacing the old 6 kV motors with modern energy-efficient 400 V motors.

During this project Eaton's local automation team benefited from the vast experience and know-how the central Eaton After Sales Service in Germany has to offer, which provided valuable support especially with regards to the system design and calculations. The inclined conveyors would have one motor each, while the horizontal conveyors would each be driven by two motors that would be torque synchronised to ensure accurate load sharing. The five existing MV switchgear cells – one for each conveyor – would also be scrapped, with each replaced by an Eaton Xiria vacuum switchgear assembly and a 6 kV/400 V transformer rated at 630 kVA for the inclined conveyors and 1.2 MVA for the horizontal conveyors.

To control the new motors, Eaton SPA/SPI 9000 series variable speed ac drives (VSDs) were selected for the inclined conveyors, and Eaton SPX series variable speed ac drives for the horizontal conveyors. A local system integrator built the drives into control panels based on floor-standing cubicles from the Eaton xVTL range.

Because it uses vacuum switching elements, the Xiria MV switchgear used for this project has a very long working life and requires almost no maintenance. It also incorporates a wide range of safety features, including inspection windows that allow instant visual confirmation of the on/off status of the vacuum interrupters. Xiria switchgear housings are also internal arc proof, offering additional protection for personnel.

The SPA/SPI 9000 VSDs used to control the motors on the three inclined conveyors are modular types with a common dc bus. In this application, SPA 9000 active front-end units are used to provide power to the dc bus, with the motors driven by SPI 9000 inverters supplied

from the dc bus. The active front-end modules offer full four-quadrant operation. This is an important benefit because the motors need constant braking when the conveyors are fully loaded, as the weight of the limestone would otherwise lead to them running at excessive speed.

Without four-quadrant operation, the energy generated by the motors while braking would have to be dissipated in resistors and therefore wasted. With four-quadrant operation, however, regeneration is possible, which means that this energy can be fed back into the supply network cutting energy costs and reducing the plant's carbon footprint. The drives are also equipped with standard brake choppers, but these are used only in exceptional circumstances to ensure that the braking function remains available even if the connection between the drive and the mains supply is interrupted.

Eaton SPI 9000 front-end modules have the further benefits of generating very low levels of harmonics, which can be still further reduced by fitting an LCL filter. They also have a power factor that is very close to 1.0, which ensures that they use energy efficiently.

Since the motors that drive the horizontal conveyors need little or no braking, drives with four-quadrant operation are not required for these. Instead, Eaton SPX drives equipped with a standard brake chopper arrangement were chosen. These units also have low harmonic characteristics and excellent power factor, as well as provision for the torque synchronisation needed for the pairs of motors used on the horizontal conveyors.

## Results

At the time of writing, all of the equipment has now been installed and two of the inclined conveyors are in regular use. They are performing faultlessly, and are providing accurate and



At the Carpatcement plant in Deva, limestone is transported from the quarry to the manufacturing plant by long conveyors



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smooth control over starting and stopping even when the conveyors are fully loaded. The regenerative operation of the drives is delivering valuable energy savings and, as anticipated, the power factor of the drives is almost unity, while the total harmonic distortion (THD) is less than 5%.