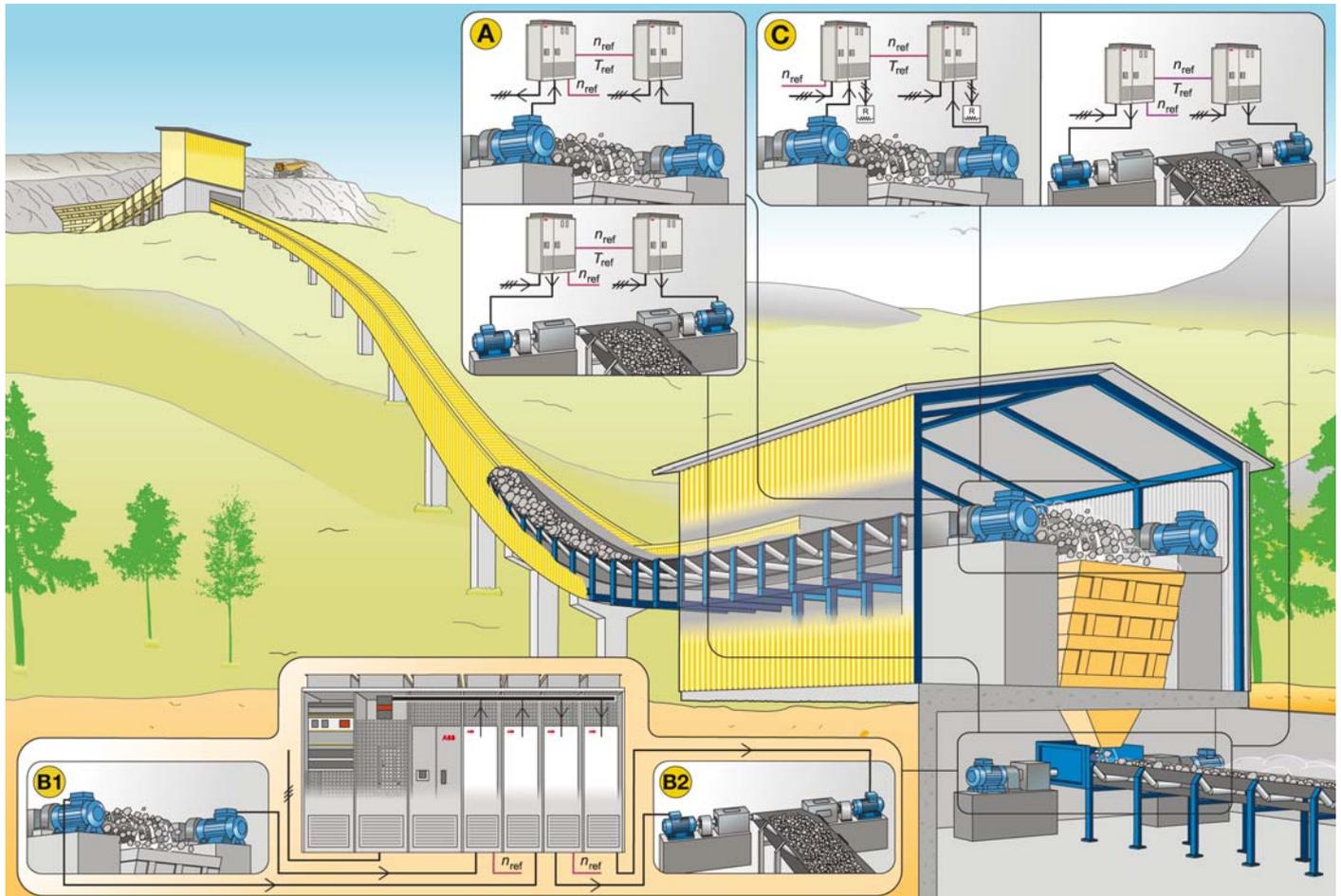


## Application note

# Downhill conveyors benefit from AC drives' energy saving capability and lower maintenance costs



A: Regenerative single AC drives. B: Regenerative common DC bus system. C: AC drives with braking choppers or resistors.

### Application description

Continuous raw material flow is important in cement making and when processing minerals. Raw materials are mostly transferred using various conveyors. Downhill conveyors are used to transport ore, limestone and other materials, from deposits high in the hills.

Continuous braking of the downhill conveyor is needed to prevent excessive movement of the belt and its raw material. The level of braking needed varies depending on the amount of raw material transported. This braking control avoids unnecessary conveyor wear. Downhill conveyors also require smooth and controlled starting and stopping.

An AC drive provides the most efficient and effective way to meet the challenges presented by downhill conveyors.

### Regenerative braking saves energy

AC drives provide accurate speed and dynamic torque control of the conveyor's belt motors. Precise speed and torque control is required for the continuous braking need demanded by downhill conveyors. With an AC drive, the braking energy can be fed back into the plant's electrical network, thereby reducing energy consumption.

AC drives offer smooth and controlled starting and stopping of the motors, minimizing belt stretching and breaking while eliminating belt slipping. This results in prolonged belt lifetime and high uptime.

### Method A – Regenerative single AC drives

Regenerative single AC drives (one drive per one motor) can be used to control the two downhill conveyor motors running the belt (see A). Both motors are mechanically connected to the belt and therefore need to rotate at identical speed and torque. Since the conveyor belt speed is limited continuously, the motors act as generators. Braking energy of both motors is fed to the AC drives, which in turn, feed the energy into the plant's electrical network for use elsewhere in the plant.

### Method B – Regenerative common DC bus drive system

A regenerative common DC bus drive system (multidrive) can be used to control the operation of the downhill conveyor and any other machines or conveyors in the process (see B1).

Here, the drive's inverter units (one inverter unit per one motor) are connected to the multidrive's common DC bus. The two downhill conveyor motors are mechanically connected to the belt, so both motors need to rotate at identical speed and torque. Since the conveyor belt speed is limited continuously, the motors act as generators. Braking energy of both motors is fed to the AC drives. As the downhill conveyor motors and the motors of other machines are connected to the common DC bus, this enables braking energy flow from the braking motors to the other motors, such as those shown in B2.

Since the downhill conveyor motors are always braking, there is no need to take any energy from the mains. For motors on applications other than downhill conveyor, there is, of course, a need to draw energy from the mains, should the braking energy produced by the braking downhill conveyor motors not be sufficient. With the common DC bus arrangement, the supply unit of the multidrive can be dimensioned to match the actual energy consumption, which is considerably lower compared to the situation where there are individual AC drives for each motor.

When stopping the conveyor, the braking energy can be fed back into the electrical network using the multidrive's regenerative supply unit.

### Method C – AC drives with braking choppers and resistors

If the amount of energy consumption is not important, the operation of a downhill conveyor can be controlled using a diode supply unit(s) instead of the above mentioned regenerative supply unit(s). Braking energy is dissipated with the help of braking choppers and braking resistors - see C.

### Master-follower arrangement

With a downhill conveyor, the single AC drives, or the multidrive's inverter units, are connected to each other in a master-follower arrangement. The master drive is given the speed reference by the automation system. The master drive then sends a speed reference and a torque reference to the follower drive. This arrangement ensures that the speeds of both motors are identical and that the load is equally divided between the motors.



At Vigier Cement, Switzerland, variable speed control of two limestone conveyors, by means of ABB AC drives, generated back into the mains over 520,000 kWh of electrical energy in less than two years.

### Benefits

AC drives provide many benefits such as:

- Minimal electricity consumption
- Reduced maintenance costs and prolonged conveyor lifetime through smooth starting and stopping
- Reduced costs paid for reactive power consumption or compensation equipment due to regenerative ABB AC drives' unity power factor
- Minimized harmonic currents through ABB AC drives' regenerative supply units
- Accurate speed and dynamic torque regulation via ABB's motor control platform DTC (direct torque control)
- Less wear and tear through equal distribution of load between the motors and elimination of undesirable dynamic effects
- Easy connection to plant automation systems via various fieldbus adapters

For more information please contact:

[www.abb.com/drives](http://www.abb.com/drives)

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