

CASE STUDY ENERGY SAVING IN A CEMENT FACTORY

ABSTRACT

This case study explores the installation of energy saving apparatus in a bucket elevator at one of the world's largest cement companies' plants. Benefits include reduction of operational costs by €1,242 to €1,797 per year and a return on investment of 15 to 24 months.

CLIENT PROFILE

The company is one of the world's largest cement factories, with sites on four continents. The SinuMEC was installed at a factory in Europe, with a 60% market share in its area.



BUSINESS REQUIREMENT

Ever increasing electricity prices and business demands for increased profitability led the company management to explore energy saving solutions.

The factory has hundreds of motors operating 19 to 20 hours a day (total of 7000 hours a year). The bucket elevator is used to elevate clinker to a cement mill.

As the amount and size of clinker changes, the load of the motor changes. While the motor is designed to start fully loaded, the actual load is significantly less than the nominal. As in many similar locations,

OVERVIEW

PRODUCT USED

SinuMEC – Sinusoidal Motor Efficiency Controller

CLIENT PROFILE

Large Cement Factory

APPLICATION

Bucket Elevator

BUSINESS REQUIREMENT

Reducing energy costs and extending equipment lifetime.

SOLUTION AND BENEFITS

Installation of Power Electronics Systems' Sinusoidal Motor Efficiency Controller designed to reduce motor voltage according to motor load improved motor efficiency and lifetime.

the motor runs most of the time with a partial load, offering significant potential for energy saving.

SOLUTION

The factory implemented Power Electronics Systems' innovative SinuMEC (Sinusoidal Motor Efficiency Controller) to induce energy savings. The SinuMEC utilizes a known phenomenon whereby reducing the supplied voltage to a partially loaded motor increases its efficiency. The uniqueness of the SinuMEC lies in its patented technology that provides pure sine wave.

While the bucket elevator control voltage was kept unchanged, the power voltages were supplied through the SinuMEC that constantly measured the power demand and changed the provided voltage accordingly.

RESULTS

An energy meter was installed to measure the energy consumed by the bucket elevator. The elevator was operated for 24 hours with the SinuMEC operational (“Save Mode”) and 24 hours where it was internally bypassed. The results can be seen in the following table:

SinuMEC Mode	Bypass	Save	Saving
kW	5.2	3.9	25%
Amp	21	12	43%
PF	0.37	0.50	26%
kVA	13.2	7.2	45%
kVA	14.4	8.4	42%

ELECTRICAL BENEFITS

The following direct benefits were obtained from the SinuMEC operation:

- Reduced direct kWh reading by 25%
- Reduced current and total power by 43%
- Reduced network & transformer losses by 66%
- Reduced reactive power by 45%, leading to reduced power factor capacitor demand and losses
- Increased motor life expectancy
- Reduced startup current and motor stress

FINANCIAL BENEFITS

The load operating conditions during the motor’s operating lifetime were assumed to be similar to those during the test period.

Since some savings cannot be measured without stopping loads, these were only estimated. To verify correct estimation, a range of values was given (more details can be found in the article “Reducing Energy and Life Cycle Costs using Sinusoidal Motor Controllers” by S. Limor and A. Broshi).

The following table summarizes the different savings:

	Min	Max
Direct power saving	1.34	1.34
Conduction losses	0.19	0.46
Transformer losses	0.19	0.46
Reduced PFC losses and harmonics pollution	0.06	0.30
Total kW	1.77	2.56

The motor operates 7,000 hours per year with a kWh price of €0.10 (\$0.15). The total energy saving per year is 12,418 kWh to 17,973 kWh. With current electricity prices this will save € 1,242 (\$1,863) to € 1,797 (\$2,696) per year, with ROI of 1.5 to 2 years and IRR (Internal Rate of Return) of 49% to 71%. The constant increase in electricity prices will shorten ROI and increase IRR. Furthermore, this will increase the life expectancy of the motor and provide smooth motor startup. The environment will benefit as well by reduction of 5,340 Kg to 7,728 Kg of CO₂ emission.

Similar benefits were measured in other SinuMEC installations in low or variable load motors such as conveyors, plastic molding machines, compressors, escalators and mixers.



SinuMEC – Sinusoidal Motor Efficiency Controller