

CASE STUDY ENERGY SAVING IN A GRANULATOR AT PLASTIC FACTORY

ABSTRACT

This case study explores the installation of energy saving apparatus (SinuMEC) in a granulator at a co-extruded and thermoformed thermoplastic factory. Benefits include reduction of operational costs by € 1,263 (\$1,894) to € 2,849 (\$4,273) per year, return on investment of 8 to 18 months and limiting startup current to 1.2 times the nominal. Following the success of this installation, SinuMEC became the standard for energy savings devices in the factory.

CLIENT PROFILE

MCP Ltd. is a dynamic developer and manufacturer of advanced, custom co-extruded and thermoformed, high quality thermoplastics for a wide range of turnkey packaging solutions.

During the normal manufacturing process, certain amounts of plastic material are removed from the final product. The recycling is done locally by a granulator located near the machine, which turns the waste into new raw material.



OVERVIEW

PRODUCT USED

SinuMEC – Sinusoidal Motor Efficiency Controller

CLIENT PROFILE

Co-extruded and Thermoformed Thermoplastic

APPLICATION

Granulator

BUSINESS NEED

Reducing energy costs, enhancing equipment lifetime and motor startup.

SOLUTION AND BENEFITS

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

BUSINESS REQUIREMENT

The increasing demand for MCP's high quality products has led to increased manufacturing capacity. A new manufacturing line was installed, including a new high power granulator.

The granulator has a 50HP (37kW) motor with direct online (DOL) startup. A different startup technique was required in order to prevent potential problems from the DOL startup, increase motor and granulator belt lifetime, and comply with local regulations.

In addition to motor startup, ever increasing electricity prices and business demands for

increased profitability led the company management to seek energy saving solutions.

Granulators must be functional at any load. Since there may be a temporary overload, the granulator's motor power is higher than that required for normal operation. As in many similar locations, the motor runs with a partial load most of the time, a fact that offers significant potential for energy savings.



SOLUTION

The factory implemented PowerSines' innovative SinuMEC (Sinusoidal Motor Efficiency Controller) to induce energy savings and motor startup.

For energy saving, the SinuMEC utilizes known phenomena whereby reducing the supplied voltage to partially loaded motors increases their efficiency. The uniqueness of the SinuMEC lies in its patented technology, which provides pure sine wave.

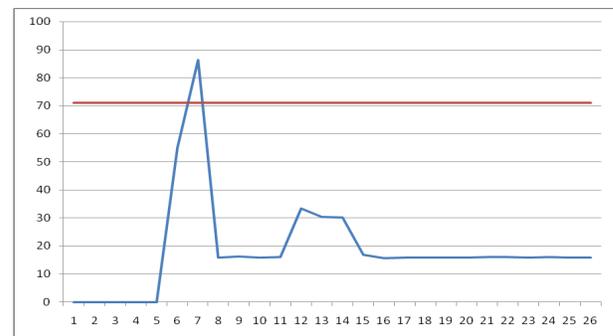
For motor startup, the SinuMEC provides reduced voltage startup. The voltage reduction is achieved by transformation, which not only provides pure sine wave also during startup but also transforms the motor startup current to lower current on the network side.

The voltages to the motor were supplied through the SinuMEC, constantly measuring the power demand and adjusting the provided voltage accordingly. The granulator's control voltage remained unchanged.

RESULTS

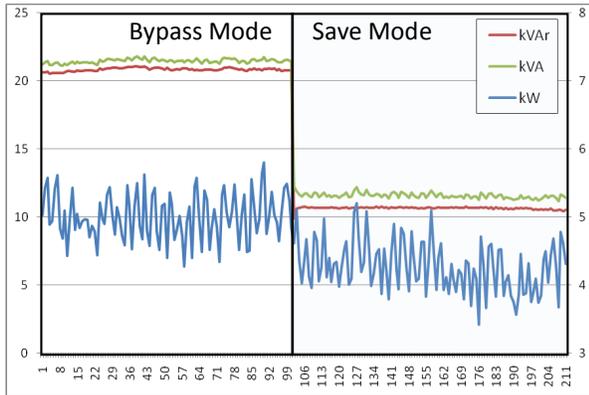
MCP's primary objective MCP was to provide reliable startup. The result far exceeded their expectations, with maximum **startup current of 1.2 times the nominal** (peak current 86A, nominal current 71A), as shown in the graph below (the red line illustrates the nominal motor current).

As seen on the graph, the SinuMEC provides reduced voltage during the startup process, in this case, 6 seconds, and thereafter the SinuMEC provides full voltage. A few seconds after startup the device measured the motor power. Based on the measurement, the device entered save mode, which reduced the steady state current by almost 50%.



In addition to the exceptionally low starting current, a data logger meter was connected to measure the energy consumed by the granulator. The values with and without the SinuMEC were compared, as shown in the table and graph below:

SinuMEC Mode	Bypass	Save	Saving
kW	5.02	4.26	15.1%
Amp	31.0	16.7	46.1%
PF	0.234	0.368	57.3%
kVA	20.81	10.68	48.7%
kVA	21.45	11.56	46.1%



ELECTRICAL BENEFITS

The following direct benefits were achieved from the SinuMEC operation:

- Reduced direct kWh reading by 15%
- Reduced current and total power by 46%
- Reduced network & transformer losses by 71%
- Reduced reactive power by 49%, leading to reduced power factor capacitor demand and losses
- Increased motor and belt life expectancy
- Reduced startup current to 1.2 of nominal
- Reduced granulator down time



SinuMEC – Sinusoidal Motor Efficiency Controller

FINANCIAL BENEFITS

It was assumed that during its entire operating life time, the load operates at conditions similar to those during the test period.

Some savings cannot be measured without stopping loads and hence were only estimated. In order 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	0.76	0.76
Conduction losses	0.31	0.77
Transformer losses	0.31	0.77
Reduced PFC losses and harmonics pollution	0.10	1.03
Total kW	1.5	3.3

The motor is operated 24 hours a day, 7 days a week with a kWh price of €0.10 (\$0.15). The total energy saving per year is 12,885 kWh to 29,070 kWh. With current electricity price this will save € 1,263 (\$1,894) to € 2,849 (\$4,273) per year with ROI of 11 to 24 months and IRR (Internal Rate of Return) of 59% to 123% on direct saving only. Since the company considered purchasing motor starter alone, when reducing the motor starter price, the ROI becomes 8 to 18 months only. As the electricity prices are constantly rising, ROI and RII times will be even shorter. In addition, this will increase the motor life expectancy and provide smooth motor startup. The environment will also benefit by reduction of 5,541 Kg to 12,500 Kg of CO₂ emission.

When Eng. Gabriel Weiner, head of electrical department, who participated in the measurement process, noticed the results he said: “Great performance! Now I want SinuMEC on all my granulators.”

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