# HOLCIM BULACAN PLANT

## Improvement of Power Factor at Crusher through Reduction of Medium Voltage and Load-based Regulation of Capacitor Operation

### SUMMARY OF THE OPTION

HOLCIM (Formerly Union Cement Corporation) Bulacan Plant is located in Bulacan, the Philippines, and produces about 1.9 million metric tons of cement per year. An assessment of the plant's electric system found that the frequencies of 16 feeders at the plant's substation were higher than 60 Hz and that the power factor for eight feeders was less than 0.85, resulting in penalty charges in the electricity bill. To reduce the power factor, the voltage of feeders was reduced to be closer to the design voltages. Financial savings result from reduced penalty charges by the electricity supplier and the payback period was immediate. There are no energy savings because the power factor has no influence on electricity consumption.

### KEY WORDS

Cement, Philippines, Electricity, Crusher, Capacitor Bank

### OBSERVATIONS

An assessment was carried out of 16 feeders at the substation and voltage (Volt), power use (kW), frequency (Hz) and power factor (PF) were measured. It was found that:

- The frequency of 16 feeders in the substation is often greater than 60 Hz, resulting in increased electricity consumption.
- The power factor for eight feeders was less than 0.85, which results in penalty charges by the electricity supplier.
- The main feeder 17, located at Transformer 1, has a leading power factor. It is understood that the leading factor occurs when the crushers are not operating.

### OPTIONS

An attempt was made to improve the power factor by slightly reducing the medium voltage (4160 V) of the feeders. The charging voltage was compared with the design voltage on the nameplate of the capacitors, and reduced to be closer to the design voltage. This resulted in slight improvements of the power factor for nine feeders. Improvements for other capacitors could be achieved, in particular for those operating continuously.

It is recommended to regulate the loads of capacitor operations as shown in the following table.

| | Before | | | | After | | | |
|---|---|---|---|---|---|---|---|---|
| **Feeder** | **Volt** | **kW** | **Hz** | **PF** | **Volt** | **kW** | **Hz** | **PF** |
| Feeder 01 Packhouse 2 | 4137 | 58 | 60.06 | -0.732 | 4093 | 50 | 60.03 | -0.727 |
| Feeder 02 Finish Mill 3 Main Drive | 4141 | 0 | 60.06 | 1 | 4097 | 0 | 60.04 | 1 |
| Feeder 03 Finish Mill 3 Aux | 4144 | 511 | 60.07 | -0.851 | 4100 | 499 | 60.04 | -0.843 |
| Feeder 04 Finish Mill 4 Main Drive | 4132 | 4464 | 60.06 | -0.924 | 4086 | 4438 | 60.06 | -0.926 |

| | Before | | | | After | | | |
|---|---|---|---|---|---|---|---|---|
| **Feeder** | **Volt** | **kW** | **Hz** | **PF** | **Volt** | **kW** | **Hz** | **PF** |
| Feeder 05 Finish Mill 4 Aux | 4140 | 1285 | 60.07 | -0.743 | 4094 | 1243 | 60.06 | -0.746 |
| Feeder 06 Raw Mill 4 Fan/BE | 4141 | 66 | 60.07 | -0.741 | 4095 | 62 | 60.05 | -0.720 |
| Feeder 07 Power Capacitor | 4135 | 0 | 60.06 | 1 | 4087 | 0 | 60.06 | 1 |
| Feeder 08 Kiln Cooler | 4123 | 2315 | 60.07 | -0.789 | 4066 | 2296 | 60.05 | -0.790 |
| Feeder 09 PH/Kiln/Baghouse fan | 4127 | 3834 | 60.06 | -0.842 | 4070 | 3819 | 60.07 | -0.845 |
| Feeder 10 Raw Mill 3 Fan/BE | 4123 | 2732 | 60.06 | -0.881 | 4066 | 2716 | 60.07 | -0.872 |
| Feeder 11 Raw Mill 3 Main Drive/Aux | 4130 | 3306 | 60.05 | -0.870 | 4073 | 3531 | 60.07 | -0.874 |
| Feeder 13 Raw Mill 4 Main Drive/Aux | 4128 | 356 | 60.05 | -0.970 | 4071 | 451 | 60.05 | -0.947 |
| Feeder 14 Coal Plant 3 and 4 | 4126 | 900 | 60.08 | -0.794 | 4072 | 913 | 60.06 | -0.808 |
| Transformer 1 Main Feeder 17 | 116053 | 230 | 60.07 | 0.723 | 116267 | 270 | 60.06 | 0.852 |
| Transformer 2 Main Feeder 19 | 116403 | 6320 | 60.06 | -0.888 | 116480 | 6260 | 60.04 | -0.889 |
| Transformer 3 Main Feeder 18 | 114193 | 13360 | 60.07 | -0.836 | 114237 | 13610 | 60.04 | -0.836 |

## RESULTS

**Financial benefits**

- Investment: none
- Annual cost savings: Reduced penalty charges on the electricity bill because of reduced power factor
- Payback period: immediate

**Environmental benefits**

- None, because reducing the power factor does not result in reduced electricity consumption

## FOR MORE INFORMATION


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