GOOD PRACTICE CASE STUDY 003

SAVING ENERGY IN INDUSTRY: ENERGY MANAGEMENT IN A METAL FABRICATION FACTORY

GHANA CYLINDER MANUFACTURING COMPANY LIMITED (GCMC)

Part of the cylinder production line at GCMC

Summary

The rising cost of electricity in Ghana has prompted consumers to look for opportunities to reduce the cost of production in order to stay competitive.

Although there are many options for reducing industrial production costs, Energy Management has been identified as one of the most simple and cost effective.

The Ghana Cylinder Manufacturing Company Ltd. is one of the industrial establishments that have taken up energy management as a cost reduction measure and have achieved significant savings in energy cost.

The company invested in a Power factor Improvement initiative in 1999 by installing automatic capacitor banks at its factory in Accra. As a result of this and other housekeeping measures, the company saved #38.17[1] in energy costs in 1999.

US$=#3,500

Case Study Objective:
The objective of this case study is to demonstrate to industrial managers that good energy management practices can yield significant benefits and improve competitiveness.

Potential Users
Although this case study is intended for all types of industries, which use several induction motors in their operations, it will be particularly useful for small and medium scale industries in metal fabrication, such as aluminium and steel fabrication industries. Technical managers and engineers would find this case study as a useful guide in evaluating power factor improvement projects in their companies.

Introduction
The Energy Foundation has for the past two years been promoting energy management and conservation measures in the industrial sector. The aim is to create awareness of the benefits of good housekeeping and energy management practices, monitoring and targeting of energy consumption and the savings that can be achieved. The Ghana Cylinder Manufacturing Company Ltd. is one of such companies that have taken up energy management seriously and have achieved significant savings in energy cost. The company saved ₵38.17 in energy costs in 1999.

Background
The Ghana Cylinder Manufacturing Company Ltd (GCMC) is a newly established plant for the production of steel cylinders of various sizes for the distribution of liquefied petroleum gas (LPG). The factory, which currently employs 55 persons, is located on the Spintex Road in Accra. It produces about 70,000 units of both 5kg and 14.5kg capacity cylinders per annum, operating at about 60% capacity.

The factory uses the batch process method for production. Imported steel blanks being are drawn into half shells which are later welded together to form a cylinder. The formed cylinders are annealed in a gas-fired furnace, to remove stress characteristics in the material caused by welding, and are then subjected to pressure and leak proof tests. GCMC's products compete on the open market with similar products, which are imported into the country, and products from another local competitor. Faced with increasing price competition, management of the company began to look for options that could be explored to cut production costs.

Energy management was one option that was considered most cost effective. As a first step in measures aimed at reducing energy costs, the company invested in power factor correction at its factory.

Energy Use
The major energy consuming appliances are the welding machines, the power presses and the annealing furnace. The company buys electric power from the Electricity Company of Ghana (ECG) via a 700 KVA transformer, at 415 V. Electricity is used mainly for running the power presses, electric motors, lighting and air conditioning. systems The annealing furnace is fuelled by liquefied petroleum gas, which is supplied from an on site storage tank. Prior to embarking on its energy management initiatives GCMC's maximum demand was about 240 kVA and was operating at a power factor of 0.68.

Power Factor Correction
The GCMC initiated a power factor correction project at its factory, as a first step aimed at reducing its energy cost. The aim was to reduce maximum demand, thereby reducing demand charges, and to avoid the payment of power factor penalties. Industrial electricity consumers, in Ghana, whose plant power factors are below a minimum of 0.90 pay a surcharge according to the formula:

$$PFS = \frac{(PF_{min} - PF_{actual})}{PF_{min}} \times MD \times MD_{charge}$$

Where Pf_{min} = Minimum recommended power factor below which a penalty is paid. This is currently 0.90.

PF_{actual} = Actual average power factor of the facility as measured by the utility meter in any billing cycle;

MD - Maximum Demand of the facility for the billing cycle, kVA;

MD_{charge} - the prevailing charge for a unit of maximum demand, #,

In line with this objective GCMC contracted Dekon Engineering Services, an Energy Service Company in June 1999 to install a 200-kVAR capacitor bank at the factory.

Following the installation, the factory's power factor improved from 0.68 to 0.0.82. Even though the GCMC has expanded production and increased its load since the installation of the capacitor, the Company's electricity demand has reduced from about 240 KVA prior to the installation of the capacitor bank, to 160 kVA.

Energy Cost Savings Achieved

The immediate benefit to GCMC of the power factor correction is an average monthly saving of #**3.18 million** accruing from lower maximum demand charges and avoided power factor penalties. This represents a saving of 36% of the company's monthly electricity bill if it had increased its load without power factor improvement

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Fig. 1.Maximum Demand Savings

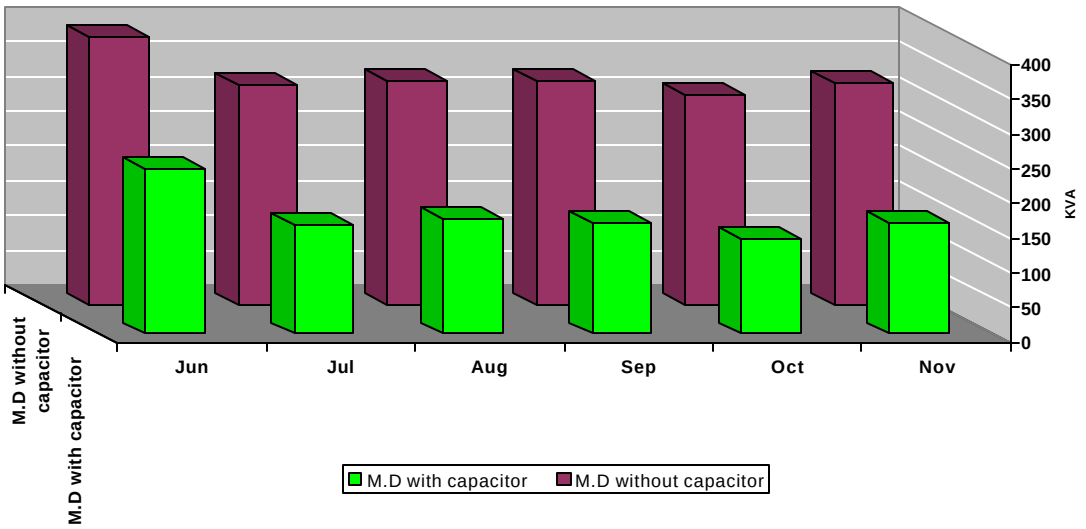
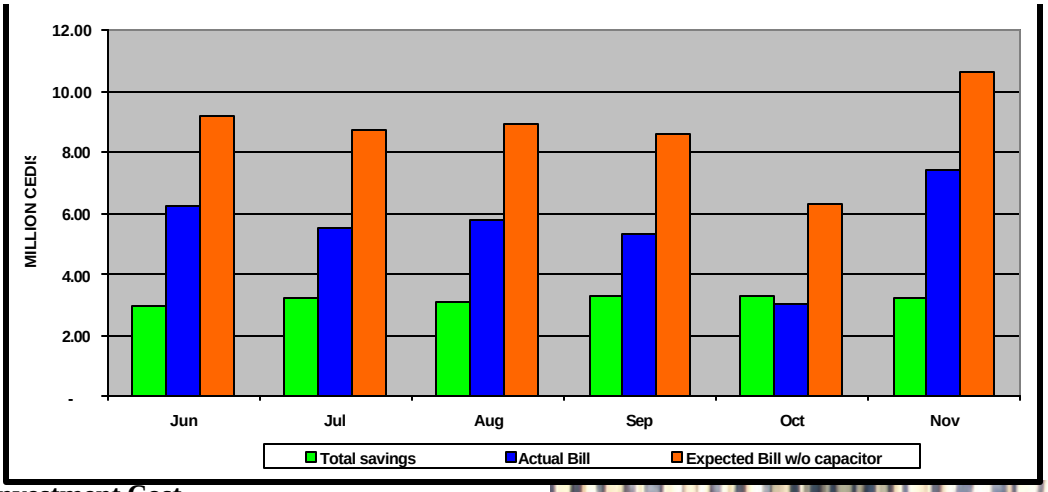


Fig.1 & 2 show that the factory's demand for electricity and cost is now much lower than it would have been without the capacitor bank. In spite of the additional load the maximum demand is still lower than what was prevailing before the installation of the 200kVAr capacitor.



Investment Cost

The total cost of the project, including cost of the capacitor bank, installation and commissioning charges was #16.758 million.

Payback period

Annual Savings = 12 x Average monthly savings: 12 x 3,181,054 = #38.17 million.
Investment Cost = #16,758,000 cedis.
Payback period is therefore 5 months.

Conclusion

Power Factor Correction has been effective in reducing the cost of energy at GCMC. With expected increases in energy costs, particularly electricity, the company is expecting to reap higher benefits. This will free up resources to meet other costs. The ultimate benefit is that the company will have a competitive edge in its product market.

The results achieved by GCMC demonstrates that energy costs in industry and commercial firms can be managed to yield substantial benefits in terms of reduced cost and improved competitiveness.

Sponsors

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