

TECHNICAL NOTE #31

Energy Efficient Technologies – Burner Replacement

The EECB facilitated a targeted Energy Systems Optimisation (ESO) Assessment at Algoa Brick as part of the National Cleaner Production Centre (NCPC) programme. This audit identified that the highest potential energy efficiency benefit focused on process heating, which could also impact on fuel economy, product quality and stack emissions.

This project provided an ideal test for the hypothesis that technically advanced new equipment can offer significant energy efficiency benefits

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ENERGY EFFICIENCY TECHNOLOGY DEMONSTRATION

BURNER REPLACEMENT AT ALGOA BRICK PLANT 2

BACKGROUND

Algoa Brick (hereinafter referred to as Algoa) is a privately owned brick manufacturer operating from a site near Swartkops, Port Elizabeth. It manufactures a range of clay bricks focussed on non-facing plaster products (NFP) which it produces from raw materials mined on site.

Algoa's Swartkops facility consists of two separate plants employing a total of approximately 150 people depending on demand. Although Algoa Brick has implemented an energy management system aimed at managing and reducing its energy costs, both of its plants are old and there is significant potential to improve their energy efficiency with judicious capital investment.

ABOUT THIS ENERGY EFFICIENCY MEASURE

The EECB facilitated a targeted Energy Systems Optimisation (ESO) Assessment at Algoa Brick as part of the National Cleaner Production Centre (NCPC) programme. The audit identified the highest potential energy efficiency benefit as lying with a focus on process heating which could also have commensurate impacts on fuel economy, product quality and stack emissions. Although there are not very many tunnel kilns firing with heavy furnace oil in South Africa, this project provided an ideal test for the hypothesis that new equipment incorporating recent technical advances can offer significant energy efficiency benefits.

KEY ACHIEVEMENTS

	Output maintained at baseline period levels	Output increased as per Summer 2017 operating regime
Implementation period	May 2016 – March 2017 (12L application continuing to February 2018)	
Estimated annual benefit ¹	R2 620 911	R2 949 546
Estimated annual energy saving	3 080 200 kWh	1 220 283 kWh
Total project cost (including M&V and report)	R1 151 905	
Payback period ¹	0.44 years or <6 months	0.39 years or <5 months
Estimated annual GHG reduction (tCO₂)²	3 018 596t	1 195 877t

¹ Estimated annual benefit (and payback by extension) is only achieved if all additional production is sold

² Eskom Annual Report 2013: 1 kWh = 0.98 kg CO₂

IMPLEMENTATION

Baseline information was drawn from Algoa Brick's existing energy management system. In order to minimise any meteorological effects, a period during January – March 2016 was compared with the post-implementation period during January – March 2017.

The burners were purchased from Bernini Impianti of Bologna, Italy. For reasons of cost, the 2 most critical out of 6 burner banks were replaced. The installation was mostly completed with the kiln operational. Ancillary requirements such as support platforms and electrical supplies were installed piecemeal in advance over a period of months. The actual burner installation took place over 4 days during January 2017 under the guidance of Bernini technicians.



The installation was regarded as complete from Monday, 23 January. Fuel oil piping was supplied by FFS Refiners.

RESULTS



The post-implementation period recorded a 12.0% increase in the quantity of bricks packaged for sale. A portion of this came from an increased throughput of 4.6% but much can be attributed to the waste reduction of 6.1%. This waste reduction can be attributed to more even and effective burning of the fuel which serves to optimise the energy obtained from the fuel and minimise any negative effects such as flame impingement.

Despite the increased throughput, overall energy consumption dropped by 2.8% (estimated annual reduction of 1 220 283 kWh from baseline) which can be attributed to the 7.1% reduction in unit energy usage. Overall energy consumption would be even lower if the throughput had not increased.

On the financial side, energy costs were actually shown to increase during the post-implementation period due to the increased use of a more expensive fuel. Notwithstanding, the significant waste reduction was seen to dominate financially and assuming that Algoa Brick can sell the additional output, simple payback could be achieved in <5 months. Should Algoa Brick choose to reduce post-implementation throughput to the same as the baseline period, simple payback could be achieved in <6 months.

The post-implementation period did not allow enough time to complete emissions monitoring. Nevertheless, the smoke plume from the stack has decreased significantly and the quantity of unburnt oil that was passing through the kiln car decks below the replaced burner banks has been eliminated.

CAPITAL / FINANCE CONSIDERATIONS

Algoa Brick originally considered capital and payback in terms of a reduction in energy costs but the value of reduced waste and commensurate increased output is seen to dominate. Clearly, the unit cost of production at Algoa Brick Plant 2 will also have reduced meaning that Algoa Brick can be more competitive in its approach. Although the outcome is bankable, it is not easy to anticipate such in advance.

Readers interested in undertaking similar projects are encouraged to refer to the “Clay brick Sector Energy Efficiency Finance Guide” available from the Clay Brick Association (CBA) of South Africa website. The difficulty in funding many Energy Efficiency projects is that it is rarely straightforward to predict the potential savings accurately but similar projects delivered elsewhere can provide a useful guide. On this particular project, Algoa Brick is in the process of submitting a 12L tax incentive application.

The 12L tax incentive (refer to the “Clay brick Sector Energy Efficiency Finance Guide” for more detail) cannot be regarded as a potential source of funding as monies are only returned via a reduction in tax well after the expense occurs (likely to be >1 year later).

Assuming that a 12L application could prove that Algoa Brick has reduced annual energy consumption by 1 220 284 kWh, taxable income could be reduced by R1 159 266 (R0.95 / kWh) which would provide an after tax (28%) benefit of R324 594. The projected cost of Algoa Brick’s 12L application is in the vicinity of R176 000. Hence, a net benefit of R148 594 could be returned which is a significant amount.

As is required by the 12L process, Algoa Brick has engaged a professional Monitoring and Verification contractor that is registered with the South African National Energy Development Institute (SANEDI). Despite this professional input, drawbacks remain such as the time delay between the application and receiving the benefit and also the likelihood that the full benefit of the actual energy reduction may not be received.

LESSONS LEARNED

- Although the energy efficiency issue can appear simple on paper, there is often more to successful implementation than immediately meets the eye.
- The value of waste reduction should not be underestimated.
- A reasonable energy management system is a prerequisite for a 12L application.
- The flaws in an existing energy management system are often not readily apparent.
- Significant advances have been made in kiln burner equipment. Despite the cost, new technology can deliver good returns.
- Good project management and measurement / metering is crucial to establish the effectiveness of the intervention.

BERNINI PERSPECTIVE

This perspective is provided by Massimo Bernini. For further information please go to www.bernini-impianti.it.

During first visits to Algoa Brick and after analyzing the production process, Bernini Impianti engineers evaluated the working conditions. The problems the client often experienced were:

- Heavy oil that did not burn properly and ended up under the brick packs and kiln car.
- A lot of time wasted on excessive maintenance and cleaning
- Presence of dark fumes delivered to the atmosphere
- High percentage of waste in the final product due to very poor pulverization of the oil and consequent bad combustion.
- Control of temperature inside the kiln not accurate.

Considering the size and requirements of the kiln, Bernini Impianti developed a technical proposal with the burner model GGT (ideal for this kiln).

Bernini Impianti supplied a high technology system composed of two groups of heavy oil burners where each group was equipped with 20 points of fire, divided on two zones with two thermo-regulators and two thermocouples.



The thermo-regulators allow the client to have total control of temperature in the preheating zone of the kiln because they are properly located on two areas, left and right.

Perfect control of pulverization of the oil and ratio air/oil perfect for each point of fire.

Now with this brand new system the combustion and firing process are exceptional. Fumes at the chimney are perfect and the unburnt oil under the kiln car has disappeared with consequent high efficiency of combustion and reduction of oil consumption.

These improvements resulted in good quality brick and reduced impact on the environment.



For further information:

Energy Efficient Clay Brick Project
The Clay Brick Association of South Africa
Website: www.claybrick.org/eecb