BENGAL FINE CERAMICS LIMITED

COMPANY DESCRIPTION

Bengal Fine Ceramics Ltd (BFCL) is a medium size producer of ceramic tableware located at Bhagalpur, near Dhaka, Bangladesh. BFCL was established in 1983 as a private limited company and its commercial production started in 1986.

The installed production capacity of the mill is 2500 ton per year. The present capacity utilization is approximately 80% or 1800 to 2100 tons of ceramic products per year. As ceramics production is labor-intensive, more than 650 employees work in this factory, which operates 24 hours per day all year round. BFCL produces high quality products that meet the quality requirements of customers in more than 18 countries worldwide. Their main customer is IKEA Trading Ltd, Sweden.

BFCL aims to be one of the highest standard ceramic companies in the country in terms of quality production, good housekeeping, highest degree of safety, conscious towards pollution and awareness on energy waste. The Company participated in another energy efficiency project called “Energy Management System” in 2001 to improve their energy efficiency. The results achieved from this project was one of the driving forces for this company to participate in the GERIAP Project and particularly to build in-house Cleaner Production and energy efficiency capacity to sustain the program.

PROCESS DESCRIPTION

The production of ceramic products is very labor-intensive. A brief description of the production process at BFCL is as follows:

- ***Raw Material Procurement and Sorting:*** Major raw materials of the plant are feldspar (stone) and quartz (stone) and chemicals, which are stored on site. Raw materials are imported, mostly from China, Thailand, Japan, England and New Zealand. These washed with a hose to remove dirt.
- ***Crushing and Milling:*** After sorting and removing dirt, the stones are transferred to the crushing section and reduced to chips with a jaw crusher and roller crusher. These chips and clay materials (China Clay, Ball Clay) are then mixed together into a granular form. Next, these stone granular forms are transformed into a body cake through the filtration process. The body cakes are then shaped in specific products such as cups, plates, etc (green ware) and transferred to the dryers.
- ***Loading and Glazing:*** Green ware is loaded in the Biscuit Kiln, which is fired at 900^0C, to make biscuit ware. In this process section various colors are added as per customers design and requirements and through this process biscuit wares are converted to glazing wares.
- ***Firing and Decoration:*** These glazing wares are fired into a 1280^0C furnace for 22 hours and send to the decoration section. Supervisors check the quality of the finished products before they are packed in the packing section.

METHODOLOGY APPLICATION

The draft *Company Energy Efficiency Methodology* was used as a basis for the plant assessment to identify and implement options to reduce energy and other materials and wastes. Some of the interesting experiences are:

- ***Task 2a – Staff meeting and training*:** Bengal Fine Ceramics' production of ceramic products is very labor-intensive with 650 staff working for the company in three shifts. Many of the energy losses are influenced by the people working in the plant (several staff was interviewed about the way they work. To identify where energy is lost and for this reason staff were informed at the beginning about the upcoming energy assessment.
Lesson learnt: in labor-intensive companies with many employees it is even more important to inform staff when an energy assessment is planned.

- ***Task 3b – Identification of options:*** This plant was also visited as a demonstration plant as part of a Cleaner Production training of the five Bangladeshi plants participating in the GERIAP project. Staff from the fertilizer plant and the trainer identified ten additional options during the plant walkthrough based on the experiences from their own plant (see table below). This was possible despite ceramics manufacturing and fertilizer production being totally different processes, because many of the equipments used and environmental problems are the same.
Lesson learnt: it can be useful to have employees from other companies join your team in the plant walkthrough because they can identify energy efficiency opportunities based on what is done at their company

Observations	Consequences	Causes	Options
Dust from material handling operations	Dusty work environment	Lack of dust suppression system	Install dust suppression system
Spillage during mixing	Manpower required to put the mix back into the process Unclean work environment	Improper material handling	Improve material handling procedures
Spillage during pumping of slurry into the moulds	Manpower and energy required to put the slurry back into the process Unclean work environment	Improper material handling	Improve material handling procedures
High energy consumption by operating fans for drying in castings	High energy consumption and costs	The installed fans circulate the same humid air resulting in inefficient drying	Provide external dry air for fans
Rejections of green ware (38-40%) due to the moulding defects	Money and materials wasted during grinding raw material, mixing and moulding	Delay in joining the different parts of the casting	Review process and operating procedures to speed up the process
Dust emission during cleaning with compressed air	Dusty work environment	Lack of enclosures	Install enclosures
Fugitive emissions during glazing	Loss of fuel Staff exposure to fugitive emissions	Air is not extracted during glazing process	Install extraction and control system
Heat loss during cooling cycle	Loss of heat and thus high energy costs	Absence of heat recovery	Install heat recovery system
Rejected ware	Monetary loss	Problems with material handling, moisture content in dried ware, and firing rate	Review process and operating procedures to eliminate causes of rejects
DG sets	Noise pollution	To generate electricity during power cuts	Not determined

- ***Task 4b – Rank feasible options for implementation:*** Ceramic products go into the oven several times during production and as a result the temperatures inside the plant get very high,

especially during summer when there is no cool air coming into the plant. Options to recover heat from the furnaces were given higher priority because in addition to energy savings the working conditions of staff could be drastically improved if the inside temperature would be reduced by several degrees. Even if the option would not be very attractive financially or environmentally, it would have received a high ranking.
Lesson learnt: it is important to consider other benefits also, such as improved working conditions, because these can be very important to the company resulting in a higher rank.

- ***Step 6 – Continuous improvement:*** The company's main client is the Swedish multinational IKEA Trading Ltd, which requires that suppliers meet their environmental standards. Because of this the company has a commercial incentive to continue to improve its environmental performance, including improved energy efficiency and reduced greenhouse gas emissions.
Lesson learnt: customers can have a major impact on whether a company will continue to improve energy efficiency.

OPTIONS

- Focus areas selected included the (1) furnaces, (2) washing of raw materials and (3) lights and fans
- Five options were investigated and of these 4 options were implemented, one is being implemented, and one was not implemented.
- For 3 implemented options and the one option under implementation for which results were quantified, the investment costs were US$ 2500, annual savings are US$ 4693, and the combined payback period was 3 months
- For 3 implemented options and the one option under implementation for which results were quantified, the natural gas savings are 67320 Nm3, electricity savings are 990 kWh and greenhouse gas emission reductions are 149 tons CO2 per year.

Table 1: EXAMPLES OF IMPLEMENTED AND INVESTIGATED OPTIONS

FOCUS AREA/ OPTION	CP TECHNIQUE	FINANCIAL FEASIBILITY	ENVIRONMENTAL BENEFITS	COMMENTS
Furnaces / Heat loss reduction from furnace by insulation, reduced operation of burners and maintained sager sizes *(see case study)*	Good Housekeeping	▪ Investment: none ▪ Cost savings: US$ 4499 (Tk 269,914) ▪ Payback period: immediate Expected results from sager sizes are: ▪ Investment: US$ 10000 ▪ Cost savings: US$ 6000 ▪ Payback period: 1.7 year	▪ Natural gas savings: 47520 Nm^3/yr ▪ GHG emissions reduction: 103 tCO_2/yr Expected results from sager size maintenance are: ▪ Natural gas savings: 63360 Nm^3/yr ▪ GHG emissions reduction: 137 tCO_2/yr	▪ Improved working conditions through reduced ambient temperature ▪ Investment costs are main barrier for sager sizing, so not this was not implemented
Furnaces / Heat recovery from furnace exhaust for reuse in dryer *(see case study)*	Production process/ equipment modification	▪ Investment: US$ 833 (Tk 50,000) ▪ Cost savings: US$ 1874 (Tk 112,446) ▪ Payback period: 5 months	▪ Natural gas savings: 19,800 Nm^3 ▪ GHG emission reduction: 43 tCO_2	Installation of full heat recovery system would result in larger savings

Water / Washing raw materials in cascade tanks instead of using a hose *(see case study)*	Production process/ equipment modification	▪ Investment: US$ 1667 (TK 100,000) ▪ Cost savings: US$ 2819/yr (TK 169,158) ▪ Payback period: 7 months	▪ Electricity savings: 990 kW/yr ▪ GHG emission reductions: 0.5 tCO2/yr ▪ Water and wastewater reductions ▪ Raw material savings: 1.65 t/yr	Under implementation at time of writing of this case study
Electricity / Switch of lights, fans, motors where is no activity & replacement of broken incandescent bulbs with fluorescent lamps	Good housekeeping	Investment: none Cost savings: US$ 294 (Tk 17,640) Payback period: immediate	▪ Electricity savings: 4.2 MWh ▪ GHG emission reductions: 2.3 tCO_2	Implemented These options were implemented after staff received training on energy efficiency
Raw materials / Management of raw material consumption patterns	Good housekeeping	Not quantified	▪ Raw material savings: included in total plant figures	Production increase

COMPANY ANALYSIS

Table 2 shows the financial analysis of the company, i.e. the changes in costs of raw materials, energy and water per ton of product. Raw material and water costs were reduced as expected. However, electricity and natural gas costs have risen per ton of product.

Table 3 shows the environmental analysis of the company, i.e. the changes in energy consumption and associated greenhouse gas emissions. This shows an increase in electricity and natural gas consumption despite the options implemented. Diesel consumption decreased. GHG emissions increased by 186.83 tCO_2 in 2004 compare to the base year 2002 due to increased energy consumption.

The explanation for the increase in electricity and natural gas consumption and costs per ton of product is likely as follows:

- Electricity consumption increased because the power supply during 2004 was more stable and therefore the in-house generator operation time was reduced. As the generator runs on diesel, the diesel consumption decreased and the electricity consumption increased.
- Natural gas consumption per ton of product increased compared to 2002, because the total production went down by 140 tons due to a shortage in raw materials supply. The burners at the furnaces and dryers must be kept running independent of production quantities. However, this does not explain the increase in absolute consumption of natural gas.

This analysis shows that the patterns in energy consumption do not only depend on implemented options to improve energy efficiency. It is therefore interesting to compare reductions for individual options with energy consumption patterns for the company as a whole.

Table 2: FINANCIAL ANALYSIS (before and after project)

Item	Unit	2002 Before project	2004 After project	Change In Unit	Change in cost In Taka
Raw material consumption	kg/ton	1432.61	1333.35	-99.26	- 1488.93
Electricity	kWh/ton	556.16	620.53	+64.38	+ 270.38
Natural gas	Nm^3/ton	1206.45	1350.02	+143.56	+ 815.44
Diesel	Liter/ton	45.21	42.95	-2.26	- 51.96
Water	Liter/ton	6164.35*	6150.13	-14.22	- 0.30
Total Production	Ton	1927.21	1788.58		
Savings (per ton production)					**Tk 455.37**

***** 1 kWh electricity (TK 4.20) is required to obtain 200 liters of groundwater

Table 3: ENVIRONMENTAL ANALYSIS (before and after project)

Item	Consumption in 2002	Consumption in 2004	GHG emission in 2002	GHG emission in 2004	Changes
Electricity	1071.84 MWh	1109.88 MWh	578.79 tCO_2	599.34 tCO_2	+20.54 tCO_2
Natural gas	2325.089 $k.Nm^3$	2414.613 $K.Nm^3$	5036.14 tCO_2	5230.05 tCO_2	+193.91tCO_2
Diesel	87.129 kiloliter	76.821 kiloliter	233.51 tCO_2	205.88 tCO_2	-27.63tCO_2
Total			5848.44 tCO_2	6065.27 tCO_2	+186.83 tCO_2

FOR MORE INFORMATION

GERIAP National Focal Point of Bangladesh
Mr. M Saidul Haq, President
Institute for Management Consultants Bangladesh (IMCB)
396 New Eskaton Road
Dhaka 1000, Bangladesh
Tel: +880-2-9353350-4, 9351102
Fax: +880-2-9351103
E-mail: srgb@consultant.com
Web: www.srgb.org

GERIAP Company in Bangladesh
Enamul Wadud Khan, Director Production
Bengal Fine Ceramics Ltd
H H Bhaban (2nd & 3rd Floor)
52/1 New Eskaton Road
Dhaka 1000, Bangladesh
Tel: +880-2-9345174, 9356085
Fax: +880-2-8314933
E-mail: bfcl@dbn-bd.net
Web: www.bfcl.net