DANKOTUWA PORCELAIN LIMITED

COMPANY DESCRIPTION

Dankotuwa Porcelain Limited (DPL) is one of the leading porcelain ware manufacturing companies in Sri Lanka. Its factory is located in Dankotuwa, a village about 60 km from Colombo in the Puttalam District and the administrative head office is based in Colombo. DPL was established in 1986 with Ceylon Ceramic Corporation as its main shareholder, and presently it is one of the leading public companies in Sri Lanka. DPL employs approximately 1,000 staff and produces 7.8 million ceramic items a year.

PROCESS DESCRIPTION

A single piece of crockery could take up about eight days to make through a labor-intensive process. The main process steps of China porcelain production at DPL are:

- ***Material preparation (dry crushing with jaw and roller crushers):*** Raw materials include feldspar, quartz, dolomite and talc, which are imported from Korea, India and China or purchased locally. All raw materials are crushed into <5mm size particles in a jaw crusher/ hammer mill and stored in material bins.
- ***Wet ball milling:*** Raw materials are mixed in required proportions and are fed together with grinding media (quartz pebbles) and water into a ball mill to grind the materials into a fine slurry or casting slip. The cast slip is pumped through a magnetic filter to remove iron particles, which are highly detrimental to the product quality. Cast slip is stored in a tank where continuous stirring takes place to keep the slurry stable.
- ***Solid casting and drain casting:*** In one process, the cast slip is fed into a filter press through a sieve and magnetic filter to form flat clay pugs, which are temporarily stored in a moisture-controlled room. The clay pugs are stripped and fed into a pug mill to form cylindrical clay pug blocks, sliced into the required thickness. These are then shaped in a so-called jigger process into a body: cup ware and flat ware. In an alternative drain casting process, cast slip is fed into a mold to shape it into cup ware and flat ware.

- ***Drying and kiln firing and glazing:*** The green ware (cup and flat ware) items are dried in dryers at 38^{O}C to remove moisture. Dried green ware is heated in a kiln at 950 ^{O}C to form biscuit ware. Damaged biscuit ware is recycled, whereas good quality biscuit items are dipped in a glaze mixture and drained. Glazed biscuit ware is then fired to 1300 ^{O}C to form white ware. Kilns used are tunnel kilns (ware is kept inside a sagger and loaded onto carts), roller hearth kiln (continuous process, ware is stacked on rollers) and shuttle kiln (batch process, ware is stacked on carts).

- ***Decoration firing:*** At the decoration section decals are placed on white-ware and fired in a kiln. In certain cases, especially where gold or platinum lines are used, white ware is manually painted.

Apart from the main process there are the following auxiliary processes:
- ***Printing and decal making:*** Decorative designs are printed on special decal paper.
- ***Glaze making:*** Glaze is used to give a surface coating to the biscuits after firing. Glaze (liquid form) is prepared in a separate process by ball milling and filtering of glazing material in a water-based medium.
- ***Mold and sagger making:*** Mold required for the molding process (drain casting) is made with plaster of Paris. Saggers are refractory containers in which ware is stacked during firing for protection from direct flames. Saggers are made by crushing sagger material, sieving, mixing with molding material, pressing, drying and firing in a kiln.

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 1a – Meeting with top management***

Management expected that most of the options with high energy and greenhouse gas reductions would involve high investments that the company could not come up with. For this reason top management expressed interest in looking into the potential for CDM (Clean Development Mechanism) projects, as part of the feasibility analysis of options, to provide the investment capital. However, the GERIAP project focuses on options that make business sense and these would not be eligible as a CDM project, although it was possible to check if any of the identified unfeasible options could in principle meet CDM criteria.
<u>Lesson learnt: It is important to be clear with top management from that start what they can expect out of the project.</u>

- ***Task 1b – Form a team and inform staff***

The Team included a representative from the accounts department who also attended the five-day technical training programme. This enabled the accounts person to understand the methodology and the technical basics of energy efficiency, which helped him to assist the Team to collect the right cost data.
<u>Lesson learnt: By including an accounts person in the Team and giving him/her training on the basics of energy efficiency, he/she will find it easier to provide the Team with the right cost information during the energy assessment and monitoring of results for implemented options.</u>

- ***Task 2d – Quantify inputs and outputs and costs to establish a baseline***

Based on the results of the pre-assessment regarding information availability and potential scope for improvement, the assessment of the three focus areas was done in different level of detail. Flue gas measurements in kilns were done in detail. The electrical system power factor and harmonic levels were also studied in detailed. But the compressed air system was only briefly assessed.
<u>Lesson learnt: Not all focus areas need to be assessed in the same level of detail, depending on factors such as information availability and improvement potential.</u>

- ***Task 5a – Implement options and monitor results***

To plan for the monitoring of results it was necessary to consider the different type of options as each needs a specific way of monitoring and amount of time and money. The different options were:

- Total elimination of sagers, by changing the tunnel kiln (gloss kiln) into a fast firing kiln
- Power factor improvement and harmonic suppression by installing an electro flow system
- Reduction of scrap clay return from pug rolls

Lesson learnt: Different options require different ways of monitoring, and allocation of time and resources.

OPTIONS

- The two focus areas selected for the project were the diesel-fired Tunnel/ Gloss kiln because it is old and inefficient and the electrical distribution system because electricity bills are high.
- Total options (1) identified (2) implemented (3) still to be implemented (4) requiring further analysis (5) found unfeasible / not to be implemented
- For the # (number) options implemented, the total (1) investment costs were ## USD (2) annual savings were ## USD (3) total payback is ## months or years (4)
- For the two options implemented for which results were measured, the total energy reductions was 2435 MW/yr and 3,535 m3 diesel, resulting in 10,198 tons CO2 and 87 tons SO2 reductions per year

Table: EXAMPLES OF OPTIONS IMPLEMENTED

FOCUS AREA/ OPTION	CP TECHNIQUE	FINANCIAL FEASIBILITY	ENVIRONMENTAL BENEFITS	COMMENTS
Diesel Fired Tunnel/Tunnel Kiln: Replacement of diesel-fired kiln that uses saggers with gas-fired fast firing kiln (see case study)	New Technology/ Equipment	▪ Investment:: US$ 2.84 million ▪ Cost saving: US$ 610,000 ▪ Cost savings from production increase: not determined ▪ Payback Period = 4.7 yrs	▪ Diesel savings: 3,535 m3/yr ▪ GHG emission reductions: 9,699 tCO_2/yr ▪ SO2 emission reductions: 87 t/yr	With the increase in fuel cost in Sri Lanka, DPL has identified other options to save energy. Existing financial constraints are a barrier and future CDM projects could therefore be an opportunity
Electrical distribution system: Installation of Electro Flow System to improve power factor and minimize harmonics (see case study)	New Technology/ Equipment	▪ Investment: US$ 50,000 ▪ Annual saving US$ 245,460 ▪ Payback period: 3 months	▪ Electricity savings: 2,435 MW/yr ▪ GHG emission reduction: 499 tCO2/yr ▪ 25% kVA reduction	

FOR MORE INFORMATION

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