Appendix 6. Brick and ceramics

Sector Specific Annex to Audit Guideline under the EE Incentive Scheme for energy intensive industries in Vietnam

1 Introduction

The purpose of this annex is to secure that the most important opportunities for energy efficiency improvements in the brick and ceramics sector are investigated.

The annex is prepared to provide more sector-specific guidance than what is presented in the general energy audit guideline prepared under the Danish/Vietnamese cooperation.

As such, the guideline describes the most important focus areas within the key technologies of:

1. **Raw materials** for the ceramics are clay, kaolin, clayey materials, feldspar and quartz. The raw materials are stored in open stockpiles, warehouses which are subdivided into boxes, large volume feeders, tempering silos, ageing silos, souring silos or dry silos

2. **Preparation of raw material** involves a number of processes depending on the product e.g. mixing, pre-drying, blending, watering, crushing, grinding and screening all to get a specific characteristic and uniform product. Some ceramic raw materials are also pre-fired, usually in rotary kilns, tunnel kilns or shaft kilns, to improve their properties.

3. **Shaping** can be done in different ways depending on the product and type of production. The shaping can be done by molding and casting techniques, afterwards applying different dewatering techniques e.g., various forms of pressing.

4. **Drying** of the ceramics is thermally done in chambers or tunnels. The temperature and speed depend of the product. But the drying is often done with hot air. Electrical (inferred or microwaves) dryers are emerging but not widely used.

5. **Surface treatment** of ceramics varies from function to decorating. The treatment can create a texture in the surface for e.g., providing non-slippery floors or it can for coloring.

6. **Firing** is a key process in the manufacture of ceramic products, as it controls many important properties of the finished ware. These include mechanical strength, abrasion resistance, dimensional stability, resistance to water and chemicals, and fire resistance. During the firing process a number of physico-chemical processes take place as the temperature increases. The temperature of the firing process varies from 800ºC (pottery) up 1,300ºC (bricks).

7. **Finishing, Sorting and pancaking** involves a final shaping by grinding, drilling, sawing and polishing. After the finishing the products are sorted and packed.

8. **Waste handling** covers both waste products from different stages but also resources as water and energy.

9. **Heat recovery systems** are applied to recover heat either at individual processes or to supply waste heat across several heat users. Heat recovery is applicable to most of the key technologies individually, while overall systemic mapping of heat recovery is also important, as energy recovered from one technological process may be used in another.

2 Technology review compared with Best Current Practice

In the table below, best practice energy efficiency projects are listed for each of the technologies above. The energy audit should consider the possible viability of each of the measures in the specific context.

The energy audit report should document how these potential measures have been considered. For each measure it should be stated whether it is practically relevant for the specific enterprise. If it could be relevant, the report must make a pre-assessment of the technical and financial viability.

No.	Technology	Energy efficiency measures
1	Raw material	• Avoid any watering during storages.
2	Preparation of raw material	• Pre-drying could be done by waste heat from the firing or drying process itself.
3	Drying	• Is automated drying control applied? The control should be based on humidity and temperature. • Is the thermal load distributed evenly in the dryer?
4	Firing	• Is the kiln proper sealed and well insulated? • Is the refractory material in the kiln optimal and in good conditions to minimize heat losses and downtime? • The use of high velocity burners to improve combustion efficiency and heat transfer. • Alternative fuels should be considered e.g. oxygen. • The heating curve should be optimized, with focus on reducing the rate of heating in the low temperature range (up to 400°C). • Is there an efficient combustion control on the kiln to make sure that combustion is operated at the optimal operation point? • Minimize the passage between dryer and kiln and also using the preheating zone of the kiln for finishing the drying process – avoid unnecessary cooling of the dried ware before the firing process. • A surplus of air in the kiln will increase the energy consumption. The air flow should be minimized.

No.	Technology	Energy efficiency measures
5	Waste handling	• Sludges can be reused to avoid the disposal and it substitutes water and other raw material.
6	Heat recovery	• Heat can be recovered from other areas than processing equipment above, by example. - From cooling zone in the firing process to the drying process. - Heat recovery can also be done in cogeneration with a gas engine.