Assessing waste heat recovery potential in a Portuguese structural ceramic industry

H. Monteiro [(1)], M. Oliveira [(2)], M. Iten [(1)]

[(1)] *Low Carbon & Resource Efficiency, R&Di, Instituto de Soldadura e Qualidade, Rua do Mirante, 33, 4415-491 Grijó, Portugal.*
+351 220 997 948, himonteiro@isq.pt

[(2)] *Low Carbon & Resource Efficiency, R&Di, Instituto de Soldadura e Qualidade, Av. Prof. Dr. Cavaco Silva, 258, Taguspark, 2740-120 Oeiras, Portugal.*

1. Introduction – Industry is accountable for 25.3 % of the final energy consumption in the EU-28 (2015), and ceramic industry is one of the main energy consuming sectors. Thermal processes (as firing, drying and spray-drying) are highly intensive and critically influence production costs. To reach the EU binding energy efficiency target of 32.5% by 2030, energy-intensive industries as ceramic industry must be addressed. Review studies on energy efficient measures [1] and best practices for this industry [2] have identified waste heat recovery as a key issue, and alternative heat recovery technologies for different thermal requirements[3]. Waste heat from kilns cooling zone can be directly used to preheat the combustion air, while heat from different streams can be recovered using heat exchangers [4]. However, heat recovery through heat exchangers is not yet a common practice. Both technical feasibility and economic reasonability need to be studied for each plant. This work, inserted in the EcoTermIP project, aims to perform a thermal energy assessment of a Portuguese structural ceramic industry plant to assess the heat recovery potential of the flue gases of a tunnel kiln to reduce fossil energy consumption.

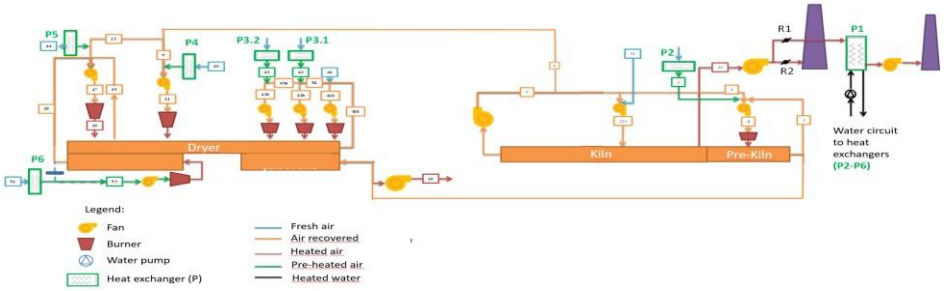

Figure 1. Existing streams and proposed Heat Exchanger network

2. Experimental – The main energy consuming processes are identified. Data collection (heat capacities and temperatures) from existing streams between the dryer and the kiln are presented (Image 1). The ceramic facility already includes heat recovery through direct use of heated air from the cooling zone of the kiln to the dryer and the pre-kiln. Hot and cold streams are mapped based on the process integration method of pinch analysis and a thermal energy assessment matching the available waste heat with heat requirements was performed to estimate the heat recovery potential from flue gases to preheat the combustion air of the tunnel kiln and the dryer.

3. Results and Discussion - The proposed heat exchanger network can achieve an annual reduction of 15 TWh of natural gas, corresponding to 500000€ savings, having a payback period of less than 3 years.

4. Conclusions – Heat recovery has a great potential to reduce energy consumption in the ceramic industry. However, many industrial stakeholders still disregard this potential because thermal energy assessments are not common practice. Disseminate the results from this case study can help other industries from the same sector to look for heat recovery solutions that fit their needs.

5. References

[1] C. Agrafiotis and T. Tsoutsos, *Appl. Therm. Eng.*, 21 (12), 2001, p. 1231–1249.

[2] European Commission, "Reference Document on Best Available Techniques in the Ceramic Manufacturing Industry," no. August, p. 210–211, 2007.

[3] H. Jouhara, N. Khordehgah, S. Almahmoud, B. Delpech, A. Chauhan, and S. A. Tassou, *Therm. Sci.*