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Optimization of lime kiln process

Abstract

Lime kiln plays an important role in the calcium cycle in the recovery area in a pulp mill. The lime kiln process consists in reburn lime mud that were generated previously at the causticizing plant. At the lime kiln the purpose is convert calcium carbonate (CaCO3) to Calcium Oxide (CaO) by using energy. Typically, the source or energy are fossil fuels and electricity.

Introduction

The goal to this project was to improve lime kiln production and also reduce fuel consumption by maintaining the lime proprieties in the desired parameters (% residual CaCO3). The paper here presented contains APC´s developed at a lime kiln from Biotek.

Methodology and Work

By evaluating operational conditions, ANDRITZ was able to develop control strategies to be implemented on the lime kiln. These controls were implemented using Metris software tool developed by ANDRITZ.

Three main controls were developed: Production Control, Residual O2 Control and Residual Carbonate Control.

The production control delivers stable and constant lime mud supply, avoiding temperatures disturbances in the feeding area of the kiln. This is fundamental for the proper kiln operation.

To burn fuel, oxygen is needed, the advanced controls must optimize the usage of the oxygen during the burning process. By doing this it is minimized the energy losses to the environment and guarantying flue gas emission standards.

The final step is the calcination process, the advanced control for the residual carbonate guaranties stable and constant temperature for the lime calcination. The kiln here presented uses two types of fuels, based on this the calcination control is capable of shift fuel consumption based on the market fuel prices, achieving the optimal cost in fuel consumption, and keeping the final product within good properties.

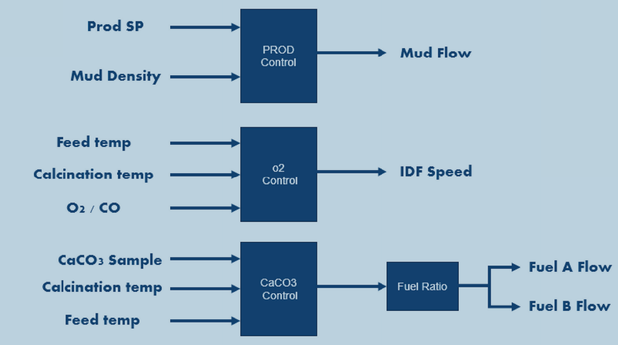

Figure 1: Controls strategy (blocks)

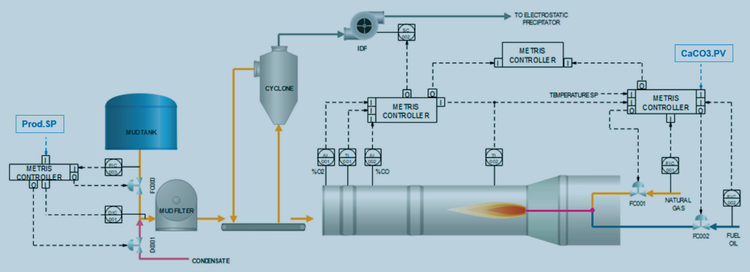

Figure 2: controls strategy (diagram)

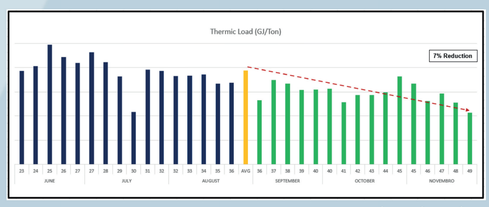

Figure 3: specific energy consumption (GJ/Ton)

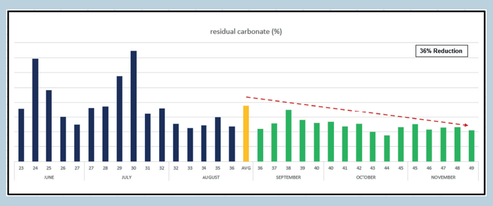

Figure 4: Residual carbonate samples

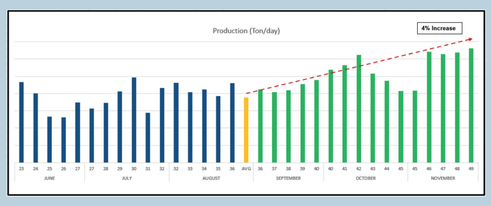

Figure 5: Lime kiln production

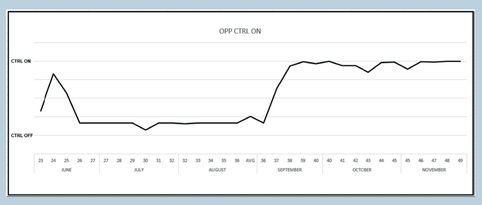

Figure 6: Uptime of OPP Controls

Figure 7: Reburned Lime sample

Results

Combined all this three Controls guarantee a better lime quality with less deviation for the demand quality and optimize the total energy used to produce lime. During this work we notice an important reduction in the energy required (7%) to produce one ton of lime (GJ/ton).

- Lime properties result in lower variability by 36% in the residual carbonate.
- The better usage of fuel on the kiln enable to increase the production by 4%.
- Average control ON, used to evaluate and tracking the perform of the Lime Kiln.

Conclusion

Combining mill technical team and ANDRITZ team it was possible to achieve this stage of operation in a high energy demanding equipment.

Afonso D. Antunes[2], João P. G. David[1], Filipe A. R. Pimentel[1], Renan P. Scarazzatti2, Nelson D. G. Camelo[1], Joaquim A. S. Afonso[1], Luís S. Sebastião

[1] Biotek S.A., Vila Velha de Ródão, 6030-223 Vila Velha de Ródão, Portugal, joao.david@altri.pt (+351964820098), filipe.pimentel@altri.pt (+351964819811), nelson.camelo@altri.pt (+351932474147), joaquim.afonso@altri.pt (+351964820079), luis.sebastiao@altri.pt (+351963317638),), jose.paulo@altri.pt (+351 927998521)

[2] ANDRITZ SAS Avenida da Força Aérea Portuguesa, nº 14, 3800-056 Aveiro, Portugal, afonso.antunes@andritz.com (+351915977986), renan.scarazzatti@andritz.com (+34660641965)

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