Industrial Internet in the Lime Industry: Advanced Burning Analysis and Combustion Optimization (ABACO™) with MOSAICO™ Intelligent Platform

EXECUTIVE SUMMARY

Parallel Flow Regenerative (PFR) technology is the best solution for the calcination process in vertical lime kilns. It assures lower production costs and simplified maintenance and operation. PFR kiln technology has been substantially unchanged since its invention in '60s, but the Industrial Internet has changed the game.

Qualical®'s MOSAICO™, which includes the ABACO™ Application (Advanced Burning Analysis and Combustion Optimization), is the intelligent Industrial Internet platform for the Lime Industry. The platform transforms operational data into actionable information, accessible anywhere and anytime. It delivers context and drives action based on equipment, location and people.

MOSAICO brings together connected machines, advanced sensors and controllers, and software for optimized performance. It provides robust analysis, visualization and reporting capabilities.

Harnessing the triple potential of:
- Sensors and connectivity
- Smart-machines
- Industrial big-data and analytics

Customers can now:
- Optimize assets
- Optimize operations
- Realize the power of 1% as small outcomes that can drive big changes in performance and operative margins.

"How much fuel should I use? Just the bare essential."
- Carlo Cella, Qualical, CEO

THE CHALLENGE

Increase the burning and combustion efficiency by at least 1% from QualiCal's PFR Kiln located in Calcis Group, Germany (operating at a German leader in the lime production) by:
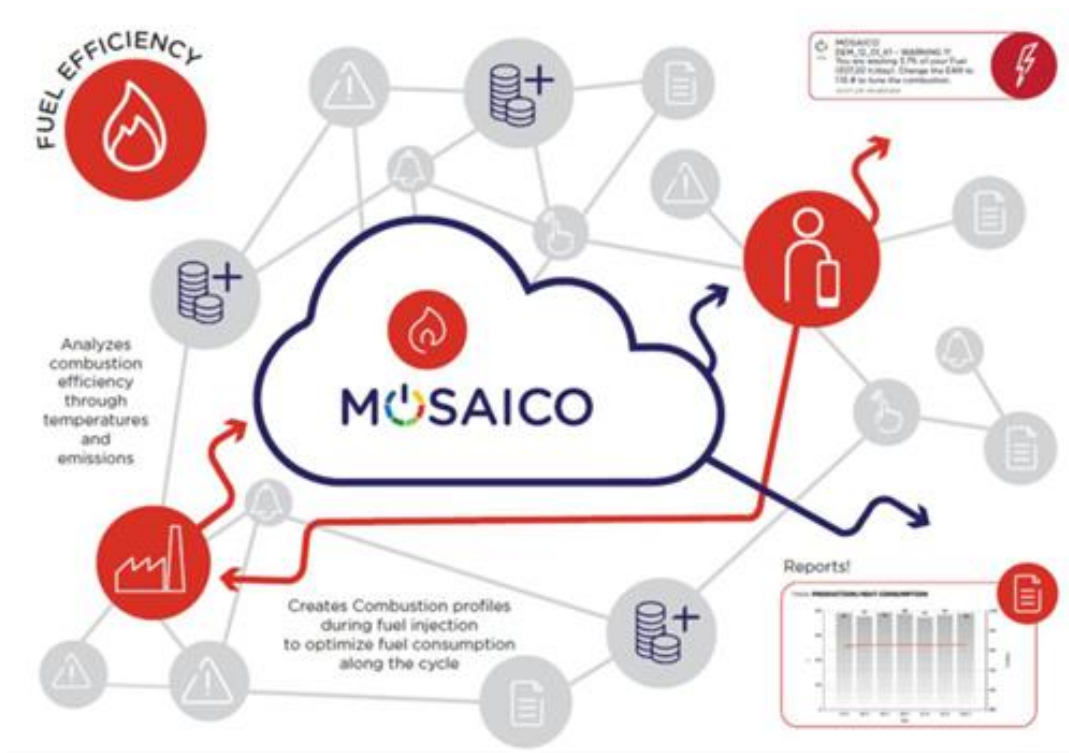
- Save fuel by reducing the unburned quantities
- Improve product quality
- Reduce thermal losses from the kiln
- Minimize environmental impact

Two main issues have been identified: CO presence in the Waste Fumes that had a negative impact on the called "Combustion Efficiency Index," and the output from the PFRK kiln in terms of temperatures (i.e. Waste Fumes and Lime temperatures) in order to improve heat efficiency and reduce negative impact on the "Thermal Efficiency Index".

THE SOLUTION

Thanks to the fruitful cooperation obtain from Calcis Management, we Developed and installed the ABACO™ Application, embedded in the MOSAICO™ Intelligent Platform, on the QualiCal PFR Lime Kiln.

Through MOSAICO, information coming from an interconnected network of smart sensors, enable Synthesis kilns to be monitored and analyzed in real-time. Maintenance technicians and supervisors can access the information directly from mobile devices, monitor asset performance, and optimize processes without the need to be present on site.

The ABACO™ app leverages advanced applications and algorithms that address specific aspects of the lime production process. The total solution deploys an interconnected network of smart sensors installed in the Qualical PRF Kiln according the IIoT Protocol.
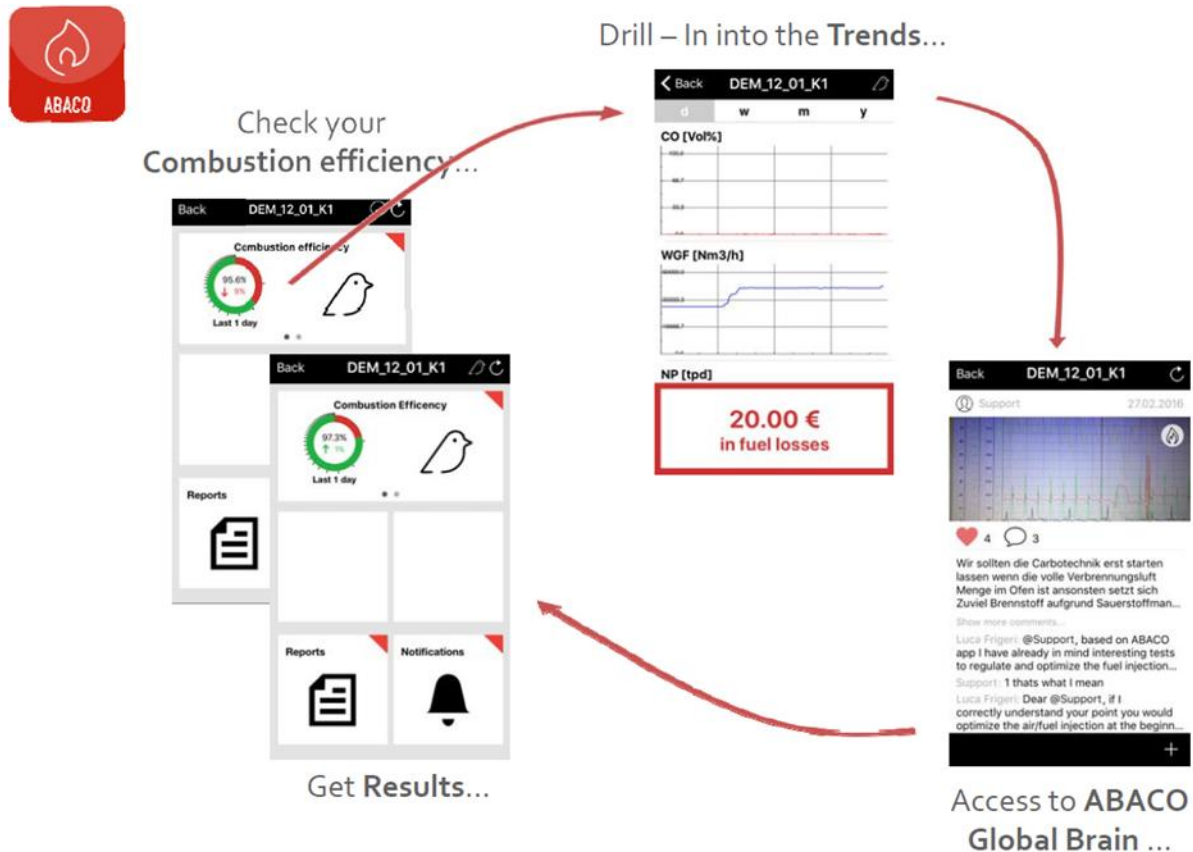
Implementing ABACO: The App, we spot every source of combustion and thermal inefficiency, allowing the Customer to operate their plant at the performance peak.
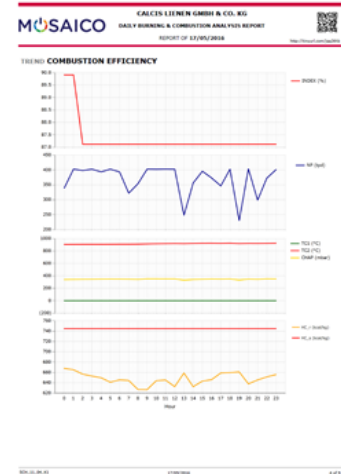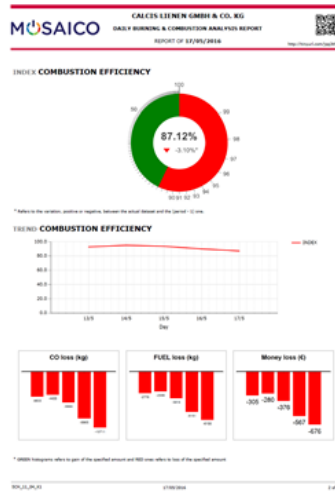
ABACO™ WORKFLOW

ABACO completely manages the burning control system to allow smooth and regular fuel feeding and avoid undesirable temperatures in the channel that can cause excess fuel consumption and undesired risks to plant and product.

Starting from the assumption that every trace of CO content in waste gas fumes represent in principle a waste of unburnt fuel, we optimize the process parameters (i.e. the Excess of Air and the Heat Consumption) in order to achieve the optimum situation of fuel injection in respect of product quality and key parameters.

Managing the Real-time feedback of waste gases analysis, ABACO creates fuel injection profiles during the cycle that automatically adjust the excess of air to avoid waste of unburnt fuel. Daily, weekly, monthly and annual reports provide system evaluation of efficiency and costs.

RESULTS

The MOSAICO mobile App, spreading Real-time operational information over different people and locations, has increased process awareness and reducing the time to take decisions

In particular thanks to ABACO™ Application, the customer is now able to monitor and analyze combustion process and detect any thermal inefficiency.
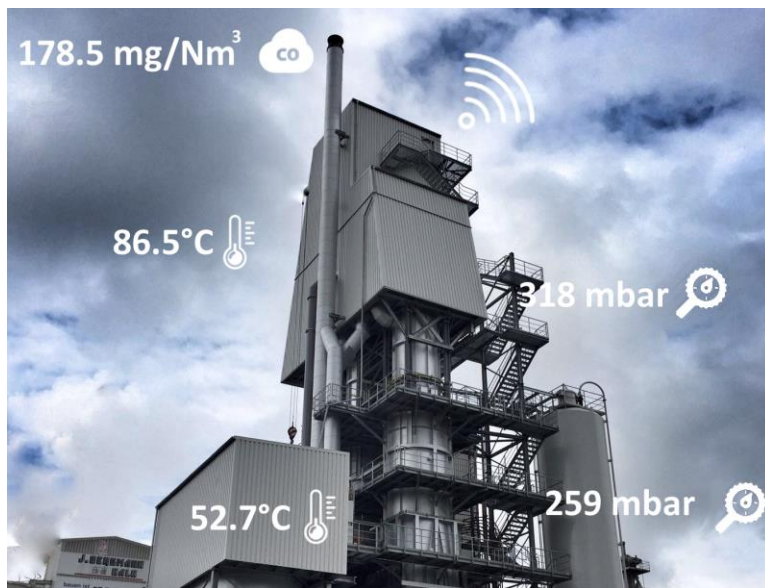

Figure 1 Qualcal PRF Kiln in Calcis Group

The analysis helps predict and prevent fuel and thermal losses realizing the power of 1%, thanks to a better administration of fuel/air ratio to the kiln, saving till to 5000 K€/month per plant in terms of fuel savings (est.)

By Big Data analysis, ABACO has enabled air – coal mix injection profiles during the cycle that automatically adjust the Excess of Air, avoiding waste of unburnt fuel, increasing the combustion efficiency up to 6%.

Be sure to see the MOSAICO ZERO Case Study linked here: http://www.iiconsortium.org/case-studies/IIC-Qualical-Case_Study_ZERO.pdf

ABOUT QUALICAL

IN ALMOST 20 YEARS OF QUALICAL WORKING IN THE LIME MARKET:

In almost 20 years of QualiCal working in the LIME MARKET:

QualiCal identified the PFR, Parallel Flow Regenerative technology, as the best for the CALCINATION in vertical limekilns and for this reason we implemented this technology in the original design of the Synthesis® TWIN SHAFT LIME KILN.

At present more than 20 kilns worldwide are in operation, confirming the validity and affordability of Synthesis solutions. Another 20 new kilns projects are in progress – from the smallest Synthesis 40, with a capacity of 150-200 tpd, to the biggest Synthesis 145 for production up to 800 tpd.

At the same time, QualiCal developed a unique and original design, providing plug & play QualiCUBE MODULAR solutions for quicklime hydration, hydrated lime classification and grinding and lime sizing.

IIoT is changing QualiCal skills and has turned QualiCal into a provider of the entire lime production experience! Combined with our expertise as suppliers of kiln components, steel and The Industrial Internet in Action - 4 - hardware, QualiCal now designs intelligent lime plans, develops advanced analytics, predictive maintenance and social open source information and provides an expert workforce dedicated to the complete lime kiln experience.

ABOUT THE INDUSTRIAL INTERNET CONSORTIUM

QUALICAL has been a member of the Industrial Internet Consortium (IIC) since **November 2014**. The Industrial Internet Consortium is a global public-private organization of over 240 members, formed to accelerate the development, adoption and wide-spread use of interconnected machines and devices, intelligent analytics, and people at work. Founded by AT&T, Cisco, General Electric, IBM and Intel in March 2014, the Industrial Internet Consortium catalyzes and coordinates the priorities and enabling technologies of the Industrial Internet. Visit www.iiconsortium.org.