

Significant process stability improvements with Carbon Re’s AI at Brazilian cement plant

GOALS

- Improve clinker quality
- Reduce fuel cost
- Reduce carbon emissions

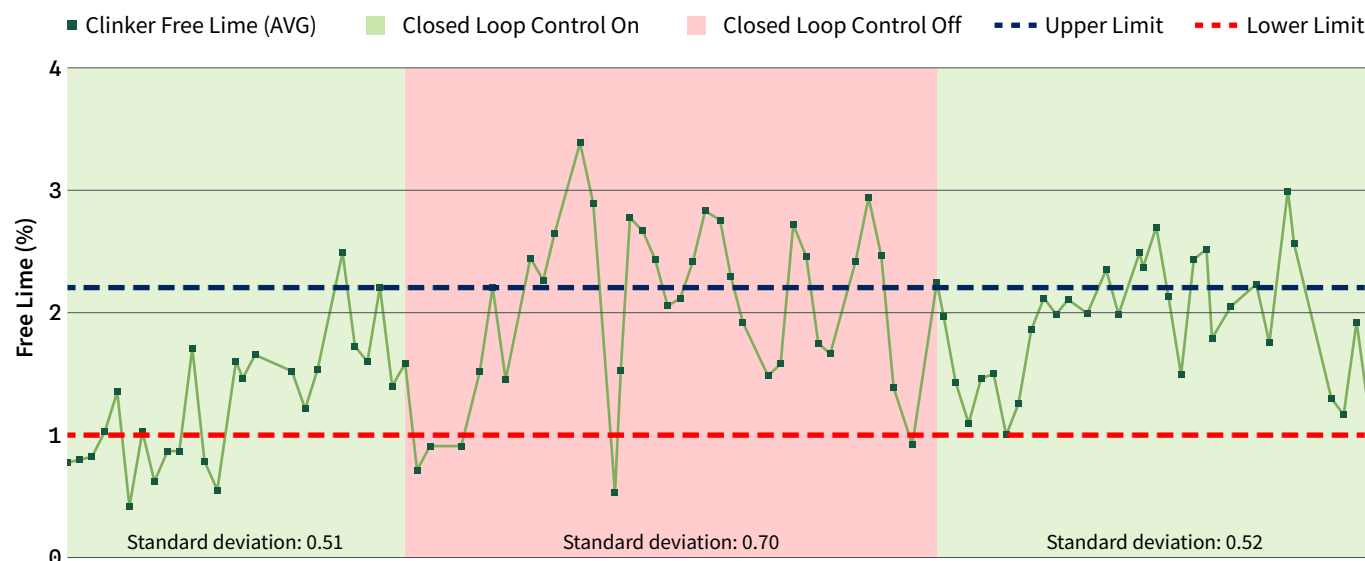
BUSINESS OUTCOMES

- 25% reduction in clinker-free lime variance
- Elimination of analysis lag for XRD/XRF measurement
- Accurate estimation of clinker quality between lab measurements

CUSTOMER

A major global cement producer collaborated with Carbon Re, an industrial AI company, to enhance its digital capabilities and accelerate AI integration across its operations. As part of its digital transformation strategy, this South American company upgraded its plant infrastructure by installing cloud historians and advanced sensor technology. This strategic investment has allowed the company to utilise its data, enabling dynamic, real-time optimisation using Carbon Re’s AI solutions.

Figure 1: Impact of closed loop control



A side-by-side comparison of the plant’s clinker quality with the Carbon Re platform on (green) and with Carbon Re off (red). With Carbon Re on, clinker quality is less variable and within the plant’s defined limits more often.

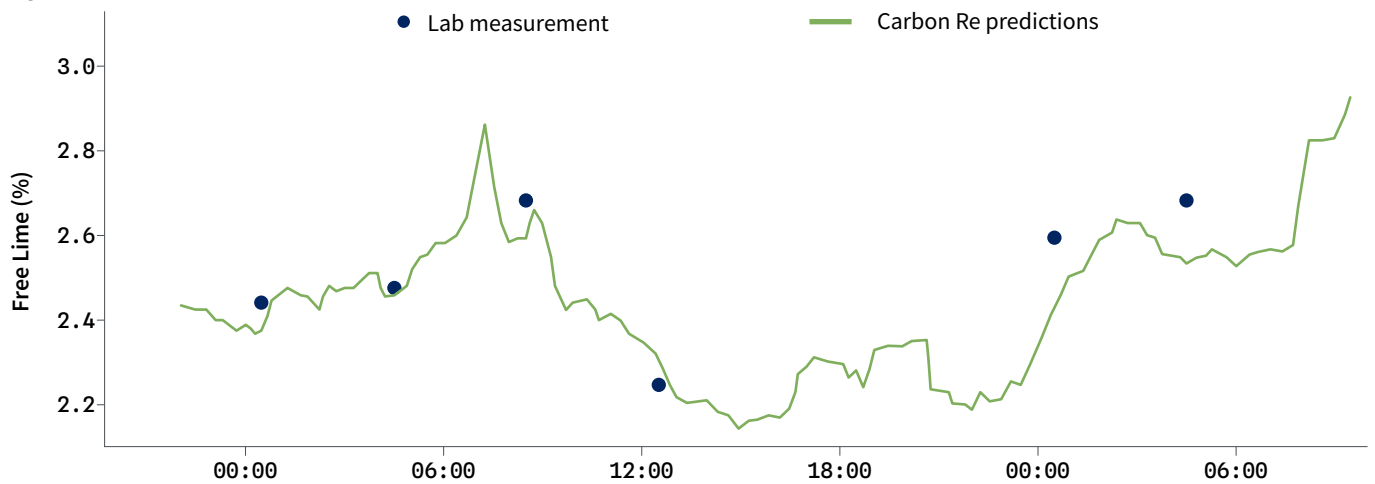
IMPROVED PRODUCT QUALITY & ROI

Using the plant's historical data, Carbon Re tailored its pyroprocess models to optimise the plant based on its current strategic objective to maximise production and consider the real-time plant conditions, such as its thermal substitution rate of up to 45%. These models, including a free lime soft sensor, a degree of calcination soft sensor and a pre-calciner temperature target, were integrated into closed loop control in the plant's advanced process control (APC), allowing for predictions and recommendations every 15 minutes to optimise the kiln operation.

With the real-time optimisation capabilities of Carbon Re, **the plant saw up to a 25% reduction in clinker free lime variance**, resulting in a more stable and resource-saving production process for the company.

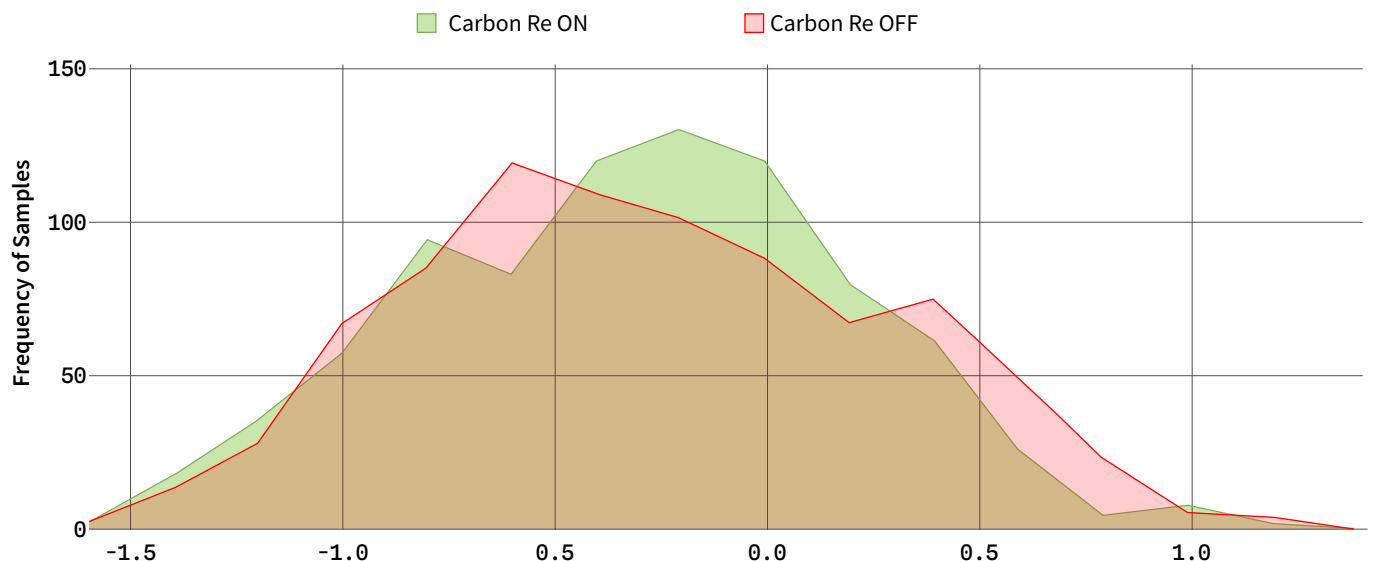
By predicting real-time values for quality parameters, Carbon Re's free lime software sensor provides the process engineers with a greater understanding of the real-time conditions in the kiln. Operators don't need to wait for physical samples to come back from the lab to enact operational changes. Instead, they can proactively adjust process targets to avoid under or overburning the clinker, enabling the improved kiln stability shown in the image below.

Figure 2: Accuracy of predictive model.



Carbon Re's free lime soft sensor provides operators with accurately predicted values of the percentage of free lime in the kiln in between laboratory samples. The graph above shows the accuracy of the predictions as they are close to the sampled values.

Figure 3: Distribution of Free Lime vs Target



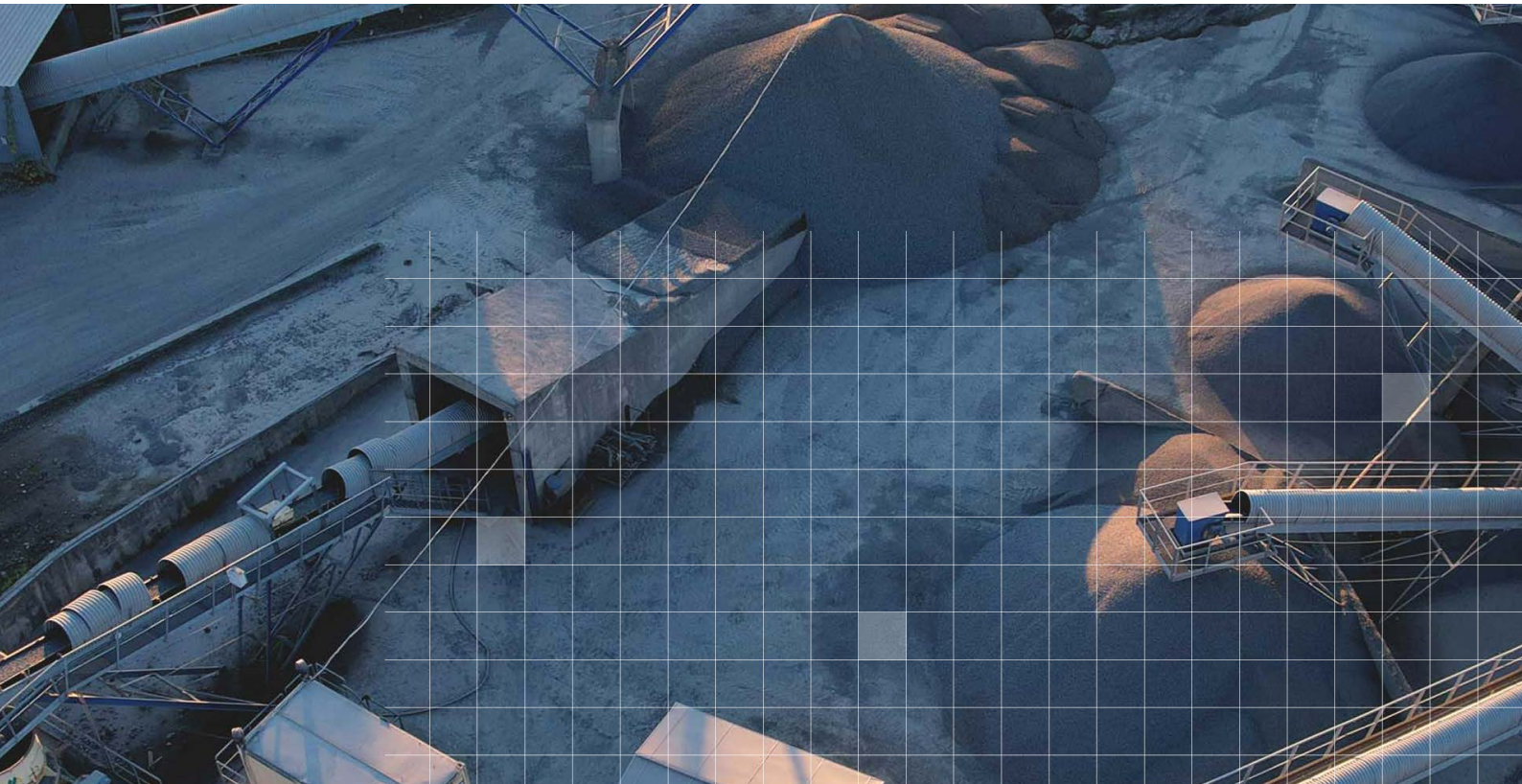
The overall effect of the Carbon Re platform can be seen in the graph above. With Carbon Re on (green), the deviation of free lime values from the target is significantly reduced.

WHAT'S NEXT?

Optimisation isn't a one-off adjustment. Continuous improvement is achieved with regular monitoring of data. With Carbon Re's cloud-based technology, the AI models are automatically retrained, providing continuous improvement in energy efficiencies, product quality improvements and carbon emissions.

With great success in reducing clinker-free lime variance by 25% at the plant, Carbon Re plans to further test its results with additional studies to validate the impact of this quality variance improvement on fuel costs.

While working with the plant, Carbon Re identified unplanned shutdowns due to blockages as a major challenge to the plant's production capacity and undertook novel research to understand how AI can help solve this problem. Now, having developed a blockage detection tool that identifies anomalies that precede a ring formation or blockage, giving operators time to adjust processes to prevent unplanned outages or minimise the severity of the build-up event, we are aiming to conduct an extended study with the plant to quantify the benefits.



To learn more about Carbon Re's solutions,
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