Project Statement

Utilising Machine Learning in the Cement and Concrete Industry

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1 Context

The attention surrounding the climate crisis has resulted in an increased focus on the need to decrease the amount of CO_2 emitted. One of the most important materials that is also one of the largest emitters of CO_2 is cement. In order to reduce the amount of CO_2 emitted from the manufacturing of cement, carbon capture systems have been suggested as a possible solution to remove carbon emitted from the atmosphere. The single largest emitter of CO_2 in Denmark, the cement production company *Aalborg Portland*, has invested in a massive carbon capture system [1], that can only function on reliable production. Therefore, they need to guarantee a reliable production with the ability to predict stoppages.

2 Problem Description

In the production of cement, before the raw material is heated and transformed into clinkers [1], the raw material is preheated in a preheater tower. A preheater tower consists of multiple funnels where the raw material is mixed and preheated in cyclones. If the raw material consists of unwanted chemicals such as chlorine or sulphur, the exit channels will slowly be blocked over time. This ultimately leads to the problem that new material entering such a funnel will eventually fill the entirety of the funnel and stop production. To restart this process, the material blocking the exit channel must be removed using explosives, such as dynamite. This is a time-consuming process that can halt production for up to two days.

[1] Clinkers are the material that, when ground, becomes cement powder

3 Objectives

The objective of this project is to utilise prediction models to predict when the preheater tower will be blocked. This includes analysing data captured from multiple sensors in the preheater tower, testing multiple different models, and evaluating the results of such models. Furthermore, the goal is to implement the model into the operations at *Aalborg Portland*.

4 Methods

The project will consist of 2 general phases. The first phase is about testing and implementing time-series models to make prediction farther into the future. The second phase consist of implementing the best performing model into the operation at *Aalborg Portland*, both as a guideline for the operators situation in the control, and as a fully automatic system that will set-off cardox-pumps automatically, to prevent blockages.

5 Expected Outcomes

The expected outcome of this project is to show a proof of concept showcasing that a time-series prediction model is able to predict blockages in the preheater tower in inference.

6 Conclusion

By limiting the amount of production stoppages, this project will investigate how utilising machine learning can help to stabilise the manufacturing process of cement, which ensures a safe and optimal usage of a carbon capture system.

References

[1] Aalborg Portland. *Aalborg Portland og Air Liquide får tilsagn om støtte fra EU's Innovationsfond til etablering af CO_2-fangstanlæg*. Accessed: 2025-09-02. 2025. URL: https://www.aalborgportland.dk/aalborg-portland-og-air-liquide-faar-tilsagn-om-stoette-fra-eus-innovationsfond-til-etablering-af-co2-fangstanlaeg/.