Enhancing Operational Visibility in Anode Baking Furnace at Emirates Global Aluminium

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Abstract

A critical need for enhanced data visibility and communication has been identified in the dynamic environment of carbon operations within the aluminium industry. The current state of operations is characterised by challenges, such as delayed data access and the potential for data-entry errors. Gap analysis revealed opportunities for technological advancement to bridge these operational inefficiencies.

The future state is envisioned as a digitally empowered workspace, where seamless communication and real-time data are the norm. To achieve this, an innovative mobile application called the "Carbon Mobility" Project was initiated. This app enables operators and managers to interact with operational data and live plant status, offering a user-friendly interface based on Web technology that makes the invisible visible.

The key implementation steps of the Carbon Mobility app include optimising the packing and unpacking processes, and integrating a firing alert system. The monitoring module of the app facilitates proactive field observations aligned with the process KPIs, enabling immediate corrective actions and efficient maintenance planning. The app is accessible anywhere, fostering a culture of prompt responses to deviations and catalysing continuous improvement. These steps are part of a comprehensive strategy to enhance the operational visibility and efficiency of the anode baking furnace (ABF).

Keywords: Carbon operations in aluminium smelter, Anode baking furnace, Operational inefficiencies, Digital technologies, Carbon Mobility app.

1. Introduction

In the aluminium industry, efficient carbon operations are essential yet often hindered by outdated processes prone to delays and errors. This paper examines the integration of digital technologies at EGA, highlighting a significant shift towards improving these operations. Central to this shift was the "Carbon Mobility" project, which introduced a mobile application designed to enhance data visibility and streamline communication within operational frameworks.

This application provides real-time access to operational data and plant status, thereby bridging the gap between floor operators and management. Web-based technologies offer a straightforward interface that minimises common data entry errors and operational delays, which are significant obstacles in traditional carbon management processes.

This document outlines EGA's steps to digitally enhance its carbon operations, focusing on the challenges encountered and the solutions adopted [1,2]. It critically assesses the areas within operations in which digital tools have led to notable improvements in efficiency and operational responsiveness. The move towards a digital working environment is presented not merely as a technological upgrade but as part of a broader cultural shift towards ongoing improvement and proactive management of operational deviations.

As the discussion unfolds, we will explore the specific functionalities of the "Carbon Mobility" application and their impact on EGA’s operations. This introduction provides the groundwork for a detailed exploration of digital transformation in an industry that is increasingly seeking to innovate and improve its processes.

2. Previous State of Operations

The operational issues that arise in a carbon plant are significantly influenced by manual entries, availability of personnel for operational tasks, and synchronisation of data exchange between the Programmable Logic Controller (PLC) signal and various sensors situated around the smelter to identify faults. The SCADA (Supervisory Control And Data Acquisition) platform, which serves as the primary visualisation and monitoring platform for the status of the plant, facilitates the verification of the implemented correction measures. This process is characterised by intricate sequences of actions and a reliance on coordination and communication among multiple parties, which places a significant burden on the operators and the operational process. Additionally, it necessitates a high level of information sharing and responsiveness as well as a lack of long-term historical records.

The entire journey is taken from identifying defects to rectifying them by analysing the operational process steps. One can highlight the bottlenecks and define them through gap analysis to identify overall improvement opportunities for the operations process. For instance:

- Reducing the delay in informing and attending to issues of the section because the Control Room Operator (CRO) is busy attending to other matters.
- Reducing the number of follow-ups and tasks for the CRO and supervisor, as they are often busy conducting specific tasks such as communication links and follow-up details.
- Provide accurate records of section history, particularly field actions conducted by operators, in a standardised database.
- Linking the gaps in anode quality investigation due to missing information, such as the actions taken in the field, their sequence, and the number of actions.
- Inaccurate tracking of baked anode production furnace-wise with rejection details, including the section, pit, and layer from which they originated
- Disparity between the written Shift Report and executed action caused by human error during data transfer.
- Maintenance is slow to fix equipment problems and repeated alerts.
- Providing the operation and general maintenance team with digitalised current equipment history (including repeated alarms and implemented actions) (coordination).
- Effective management of multiple types of anodes requires precise inventory management; however, this is not currently maintained. This results in production planning complications and unreliable manual counting of anodes.
- Keeping manual records is inefficient and unreliable (Figure 1).

Table 1. Workflow improvement.

Aspect	Previous Workflow	Improved Workflow
Sequence of Actions (Figure A)	• Alarm in control room. • CRO identifies and acknowledges alarm. • Information communicated to maintenance or field operators. • Attending the concerned section. • Implementing corrective actions. • Updates provided to stakeholders. • Confirmation of implementation and improvements reported back to supervisor.	• Alarm in control room. • Automated alert sent to appropriate personnel. • Real-time monitoring of actions. • Immediate updates to stakeholders. • Confirmation and feedback mechanisms integrated.
Sequence of People (Figure B)	• CRO initiates the process • Field Operators receive information and act. • Supervisors/Superintendents oversee and ensure compliance. • Maintenance addresses technical issues	• CRO initiates the process. • Automated alerts facilitate quick response. • Supervisors monitor real-time updates. • Maintenance receives precise information for quick action.
Communication Flow	Manual and complex information exchange among CRO, field operators, supervisors, and maintenance personnel, leading to potential delays and inefficiencies.	Streamlined communication via a digital interface, reducing manual exchanges, improving response times, and enhancing operational efficiency.

5. Operational Enhancements

The application seamlessly integrates with existing SCADA and PLC systems to enhance data accuracy and availability. Features such as inventory management modules have improved task approaches and completion.

6. Way Forward

Expanding on our current successes, the next phase will focus on increasing the app's usage across similar process units to ensure a unified digital experience throughout the plant. Integrating with other information systems will further enhance operational synergy and data utilization to drive decisions as EGA's digital ambition is implemented and advanced technologies become available [1, 3, 4].

7. References

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