# **Babcock delivers fast-tracked** refinery boiler upgrade project

As South African refineries continue to modernise ageing infrastructure to improve environmental compliance and operational reliability, the ability to execute complex boiler modifications within constrained outage windows has become increasingly important.

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Babcock recently completed a fast-tracked industrial boiler upgrade project at a major South African refinery, supporting the facility's broader programme to enhance plant performance and meet statutory emissions requirements. Despite the complexity created by overlapping project phases and a compressed delivery schedule, the project achieved mechanical completion and commissioning within the revised outage programme.

The project demonstrates Babcock's capability to execute technically complex retrofit work within operating refinery environments while maintaining strong safety performance and schedule certainty.

## Supporting performance and environmental compliance

The upgrade was part of the operator's ongoing programme to enhance plant reliability and environmental compliance through targeted infrastructure upgrades.

The project required modification of an existing boiler to enable the full routing and treatment of the flue gas stream, ensuring compliance with statutory emission limits while improving plant utilisation.

According to Puvern Pillay, Project Manager at Babcock, the project represented a critical intervention to ensure both regulatory compliance and operational continuity within a live refinery environment. "Execution had to take place where safety, schedule certainty and operational integration were critical, requiring close coordination across engineering, procurement and construction teams," he explains.

Pillay led the project through engineering, procurement, construction and commissioning within this complex operating environment.

## Complexity and fast-tracked delivery

The project was executed under a dual-contract structure, with detailed engineering awarded separately from procurement and construction. While commercially necessary, this created a fast-tracked execution environment in which engineering maturity, procurement placement and construction readiness progressed in parallel rather than sequentially.

"As a result, downstream activities were highly sensitive to design development, vendor inputs and approval cycles, introducing integration and delivery risks early in execution," says Pillay.

To address this, the project team focused on stabilising execution across initially misaligned interfaces. This required a shift from discipline-based progress measurement towards integrated delivery planning, ensuring engineering outputs were continuously evaluated against procurement and construction readiness rather than measured in isolation.

## Adaptive execution

As engineering progressed, several critical work packages experienced delays due to evolving validation requirements and extended approval processes. Rather than allowing these challenges to impact outage readiness, the project team implemented an adaptive execution approach focused on maintaining delivery momentum.

"Given the aggressive overlap between engineering, procurement and construction phases, we had to adopt an iterative execution approach that allowed solutions to be developed dynamically. Strong integration between engineering, project management and construction teams was central to this," Pillay explains.

Construction sequencing was continuously reassessed, enabling progressive advancement of work fronts as materials became available. Piping, ducting and structural installations were executed in phases, while independent activities were accelerated to maintain productivity.

## Coordination: critical to delivery

Close coordination between engineering, procurement, construction and subcontract teams played a key role in maintaining delivery certainty. Scenario planning and proactive risk management enabled the project team to maintain progress while preserving safety and quality standards within a congested refinery outage environment.

Stakeholder management also proved important. The evolving scope required disciplined change management while maintaining collaborative relationships with the client and operational teams.

By ensuring transparency in technical decision-making and aligning discussions with project outcomes, the team managed scope growth without disrupting execution.

"Credit must go to the client for the collaborative approach adopted throughout execution. This was a critical success factor in a fast-tracked project where compressed timelines and parallel workstreams required rapid, joint decision-making," says Pillay.

Despite early schedule pressures and execution complexity, the project achieved mechanical completion within the revised outage programme and progressed successfully through commissioning.

Safety performance remained a key focus throughout construction, with the project achieving:

- Zero Lost Time Injuries.
- Full compliance with refinery safety systems.
- Successful quality validation of all modifications.

The outcome reflects disciplined planning, strong coordination and adaptive execution under challenging delivery conditions.

## Lessons from execution

According to Pillay, one of the key organisational lessons from the project is the importance of focused integration management. "Projects executed under overlapping EPC structures require strong integration between engineering, procurement and construction planning from the outset," he notes.

The project also reinforced the importance of aligning contracting strategies with execution realities and maintaining flexibility within delivery teams. "Beyond the immediate delivery results, this work strengthened our organisational capability in managing fast-tracked delivery environments and reinforced the importance of tightly linking engineering maturity to downstream execution readiness," he adds.

The successful delivery of the project highlights Babcock's capability to execute complex boiler modifications and retrofit work in live refinery environments. The project reflects the company's broader capability in supporting industrial customers through lifecycle asset support, performance upgrades and environmental compliance improvements.

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As refineries and petrochemical operators continue to modernise infrastructure to meet environmental and operational requirements, demand is expected to grow for engineering partners capable of executing complex brownfield modifications within operating plants.

Projects of this nature demonstrate the importance of integrated engineering execution, strong planning discipline and collaborative delivery models in achieving successful outcomes.

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# Applying engineering discipline to restore milling plant reliability

Reliability of coal milling plants remains a critical determinant of performance in coal-fired steam generation facilities. However, many ageing installations continue to experience recurring failures driven by structural degradation, alignment deficiencies and historically reactive maintenance strategies.

Experience at Babcock demonstrates that engineering-led rehabilitation programmes can restore milling plant stability without the significant capital investment required for a full mill replacement.

When Babcock assumed long-term maintenance responsibility for a site's large steam generation milling plants, baseline conditions included accumulated service backlogs, compromised system redundancy and maintenance programmes that had become largely reactive.

Operational data indicated frequent mill outages linked to high vibration levels, lubrication failures, pulverised fuel leakage and drivetrain failures. Engineering investigation showed that these failures were frequently symptoms rather than root causes.

Detailed inspections revealed several mechanical deficiencies contributing to recurring failures. Distorted gearbox baseplates, movement at holding-down bolts, inappropriate washer selection and the absence of epoxy resin locking all resulted in progressive misalignment during operation.

In addition, long-term oil and water contamination had reduced the stiffness of certain concrete foundations, contributing to structural instability. Localised repair methods, including partial machining or grouting, were found to provide only temporary improvement.

To quantify mechanical conditions, Babcock applied advanced diagnostic methods, including 3D laser scanning and point cloud analysis.

These investigations identified several key contributors to instability:

- Non-level baseplates.
- Eccentric mill centre lines.
- Misaligned labyrinth seals.
- Inconsistent bolt configurations.
- Soft-foot conditions at gearbox interfaces.

These issues contributed directly to pulverised fuel leakage, hot primary air ingress and increased loading of couplings and bearings.

Engineering work focused on restoring the mill's mechanical reference structure. Corrective actions included baseplate replacement, precision levelling, standardisation of holding-down interfaces and elimination of soft-foot conditions. Seal alignment corrections were also implemented to reduce PF leakage and thermal loading. All this corrective work was executed in accordance with OEM design requirements.

Following corrective engineering interventions, milling plant redundancy was restored, and vibration-related defects were significantly reduced. Recurring gearbox, coupling and lubrication failures were largely eliminated, allowing maintenance execution to shift from reactive breakdown response toward planned maintenance programmes.

In addition to technical interventions, Babcock worked with plant personnel to transfer alignment capabilities, formalise preventive maintenance routines and improve spare component selection. This ensured that reliability improvements could be sustained within the plant's own operational practices.

As many coal-fired power stations continue operating with ageing milling infrastructure, engineering-led rehabilitation programmes offer a practical alternative to full equipment replacement. Experience from these interventions shows that correcting structural and alignment deficiencies can significantly improve reliability while extending asset life.

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