Blower System Energy Cost Improvement

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Presentation overview

- Introduction
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- Results and discussion
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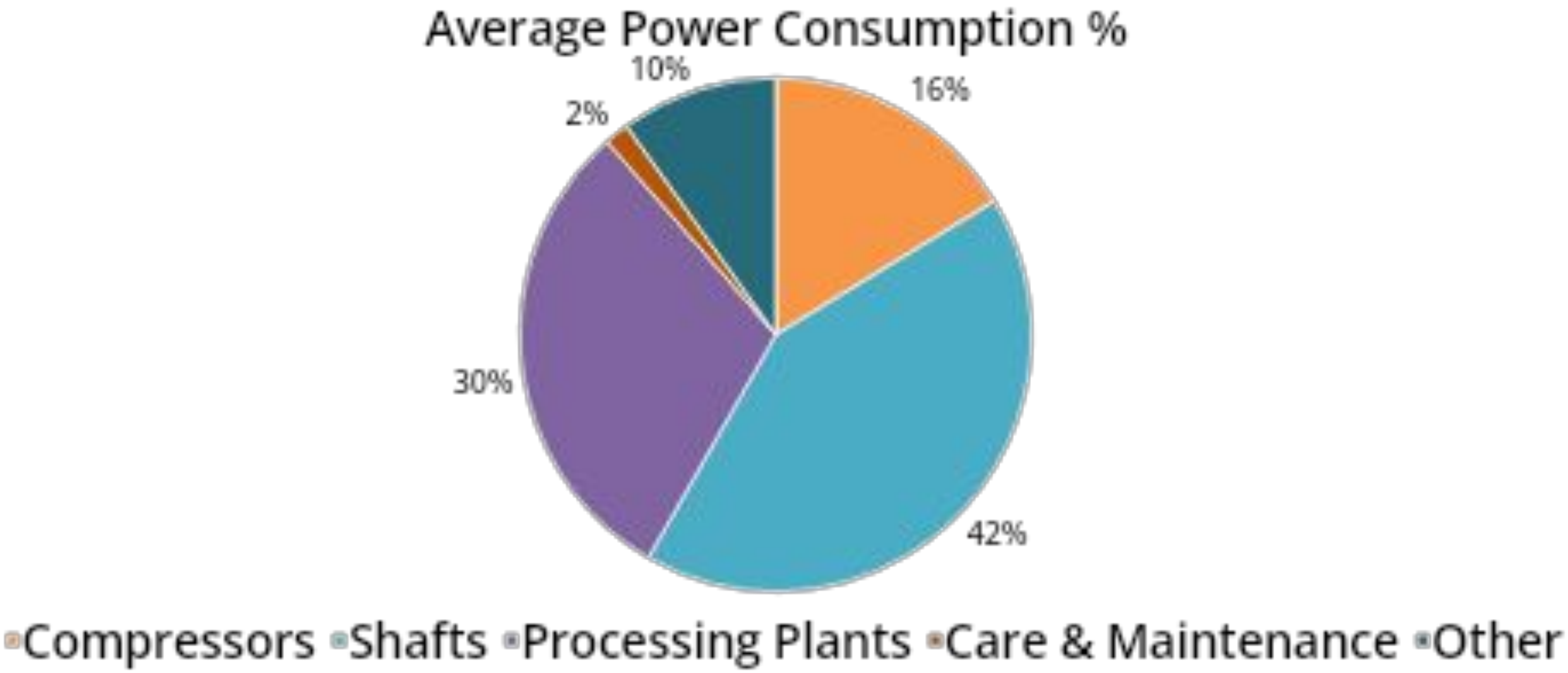
  - Implementation
- Conclusion

Introduction - Background

- Since 2013, the price of platinum has dropped by approximately R9 000 per ounce, leading to shrinking profit margins for platinum operations [1].
- Utilities rank as the third-largest expense in mining operations, following labor and supplies [2].
- For platinum mines to maintain financial stability, implementing energy-saving measures is essential [3].
- Processing systems are major energy consumers in mines, yet little research addresses electricity cost reduction in platinum facilities like concentrators, smelters, refineries, and tailings plants, likely due to the difficulty of saving energy in continuous operations [4, 5].

Introduction - Background

- Significant efforts have been directed toward reducing shaft energy consumption through DSM initiatives [6]
- The investigated area spends approximately 30% of its electricity on processing plants.
- Energy cost saving initiatives on plants have not been thoroughly investigated [4]



Introduction - Background

- Limited literature exists on identifying energy savings opportunities on platinum plant auxiliaries [7]

- Potential to achieve energy savings by optimizing plant auxiliary systems:
  - Compressed air (blowers, compressors, fans)
  - Material transfer (conveyors)
  - Pumping systems (sump pumps, tailing pumps)

- No methodology exists regarding identifying and implementing energy savings on blower systems at platinum concentrators.

Introduction - Need for the study

- Problem statement
  - Platinum plants account for a substantial portion of the total electricity consumption in a platinum mine.
  - Previous studies have indicated that DSM of plant auxiliaries have potential for cost savings
  - DSM of blower systems have not been thoroughly investigated

- Objectives
  - Develop and implement a strategy to generate cost savings for blower systems at concentrators.

Development of solution

Data acquisition

Analysis

Implementation

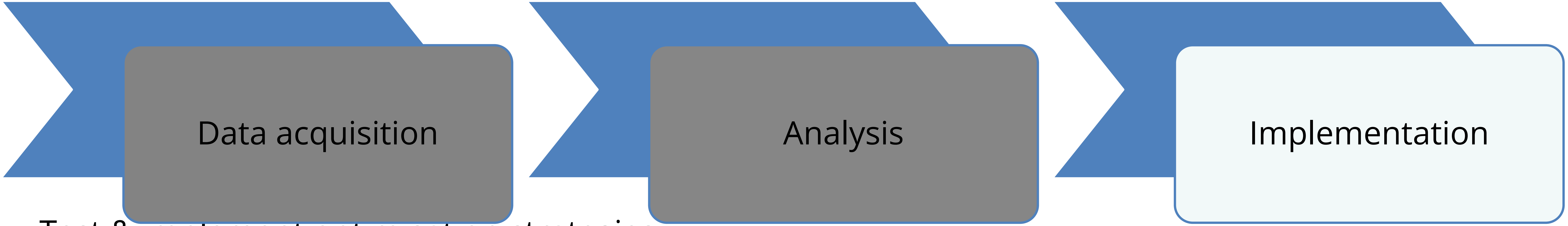
- Obtain site layouts and equipment specifications
- Blower performance curves
- Conduct site audits
- Obtain historical data

Development of solution

Data acquisition → Analysis → Implementation

- Determine system operation parameters
- Identify wastage
- Verify actual data with values obtained from the blower curves
- Scope
- Identify a potential solution

Development of solution

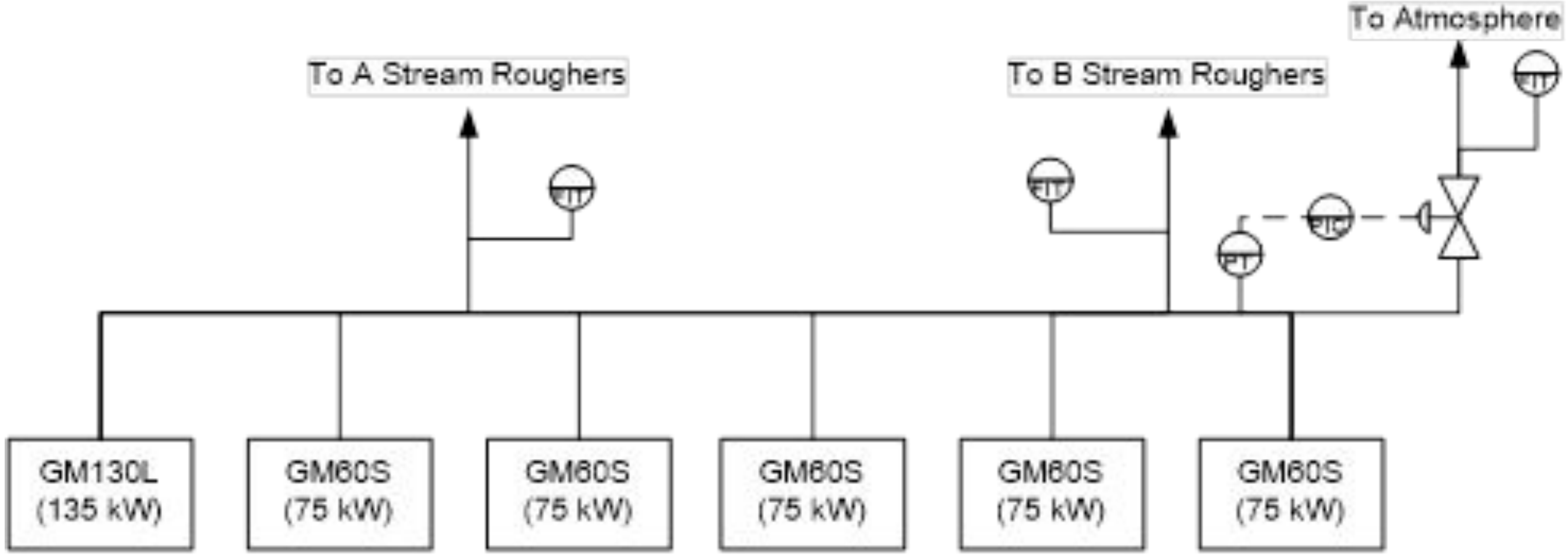


- Test & implement optimisation strategies
- Verify savings
- Ensure consistent savings through continual energy reporting
- Ensure production not affected

Results and discussion

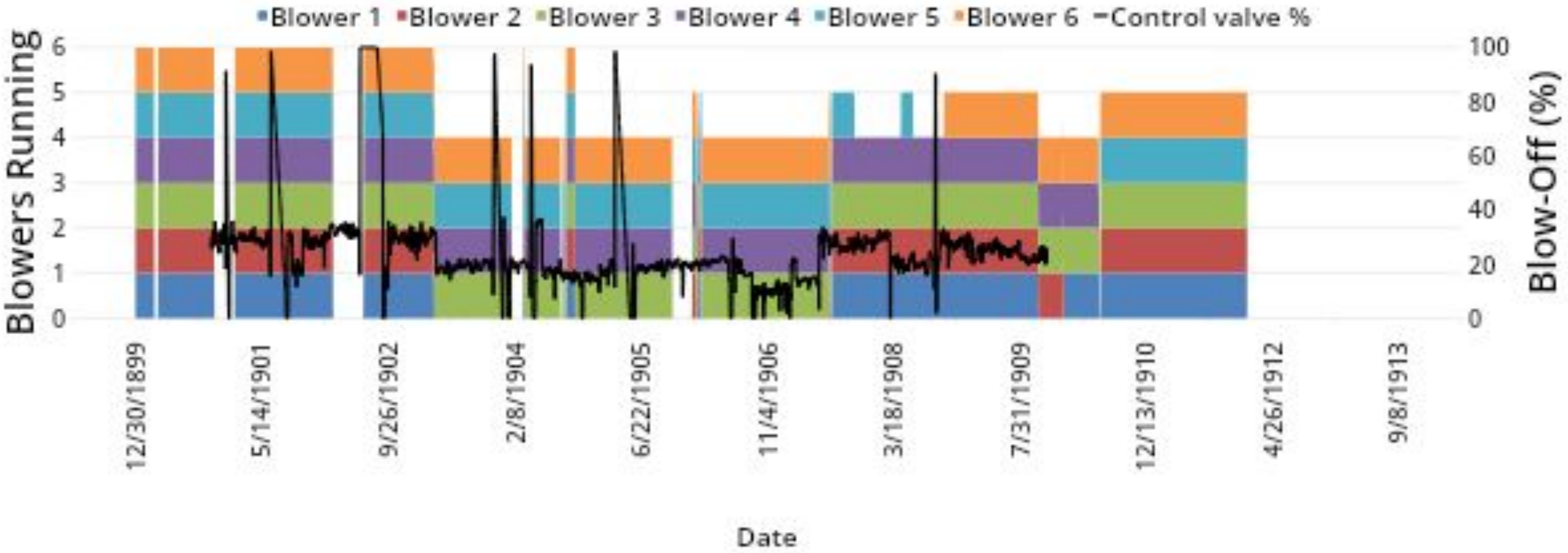
Case study	Reef processed	Plant capacity (t/d)	Type	Differentiating system characteristics	Blower type	Operating pressure (kPa)
A	Merensky & UG2	7 500	Fresh Ore	Self-aspirating flotation cells retrofitted to work with blowers.	Positive displacement	30
B	Merensky & UG2	16 000	Fresh Ore	Significant leaks, multiple blow-off valves.	Positive displacement	56
C	Merensky & UG2	17 000	Tailings	Frequent pressure setpoint changes.	Positive displacement	53 – 55
D	Plat Reef	29 000	Fresh Ore	Centrifugal blowers	Centrifugal	65

Case Study A – Data Aquisition



- Header pressure setpoint: 30 kPa (constant during study period)
- Retrofitted self-aspirating flotation cells
- Data review period: 1 April 2024 to 1 July 2024 (3 months)
- Analyzed historical blower operation and flotation cell performance data

Case Study A – Analysis



- Blower usage varied: 6 blowers (April) reduced to 4 blowers (May)
- Header pressure consistently maintained at 30 kPa setpoint
- Control valve opened wider when additional blowers started, venting excess air to atmosphere

Case Study A – Analysis

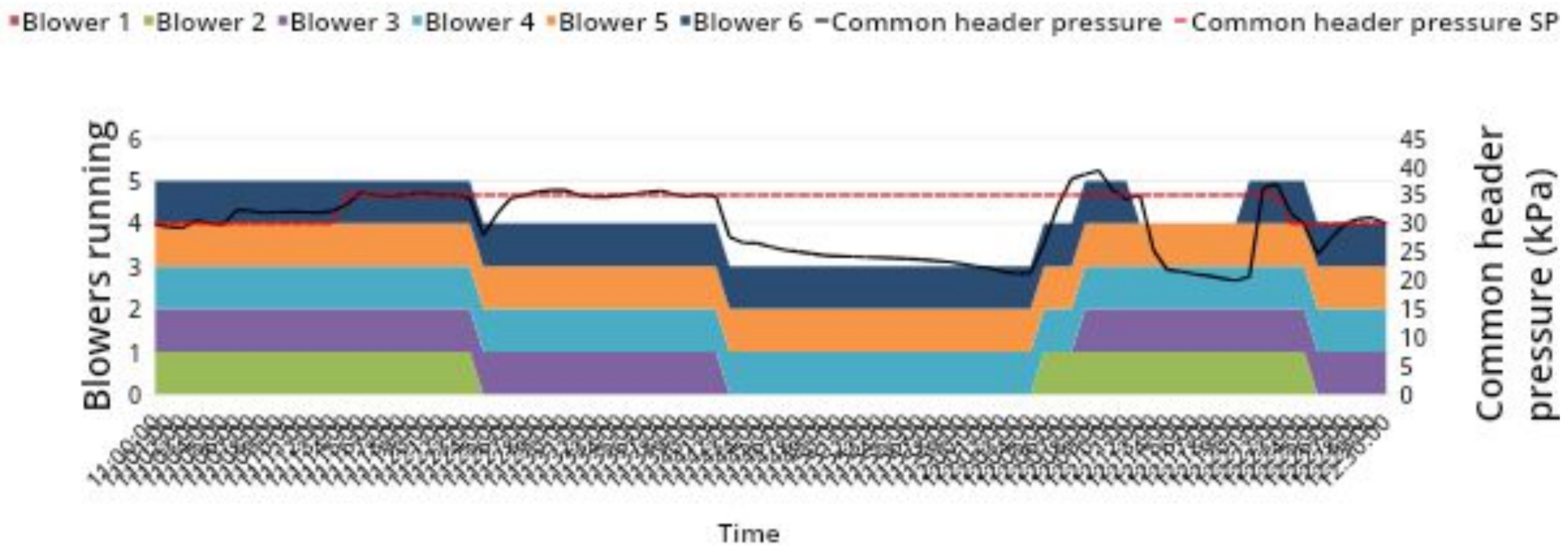
Month	Average Demand (m^3/min)	Average Supply (m^3/min)
April	206	330
May	187	269
June	190	299

- **Blower Capacity (at 30 kPa)**
  - GM130L: ~109 m^3/min
  - GM60S: ~61 m^3/min each
- **Recommendation**
  - Operate only 3 blowers (1× GM130L + 2× GM60S) to meet demand
  - Combined capacity: ~231 m^3/min—sufficient for observed requirements
  - Potential for significant efficiency improvement

Case Study A – Implementation

- To test the proposed configuration under real conditions, a site test was conducted.
- **The test procedure:**
  - (1) Under stable operation, one GM60S blower was turned off.
  - (2) System response was monitored for at least 10 minutes, up to 30 minutes.
  - (3) If the blow-off valve percentage was high and setpoint (SP) was maintained, another blower was turned off.
  - (4) If pressure reduced below SP or only three blowers remained, blowers were cycled (one stopped, one started) after the system was given 10 – 30 minutes to respond.
  - (5) The test was repeated across setpoints from 30 kPa up to 35 kPa in 50 mbar increments.
  - (6) The test ended when all blowers were cycled or if operational impacts prompted site personnel to request early termination.

Case Study A – Implementation

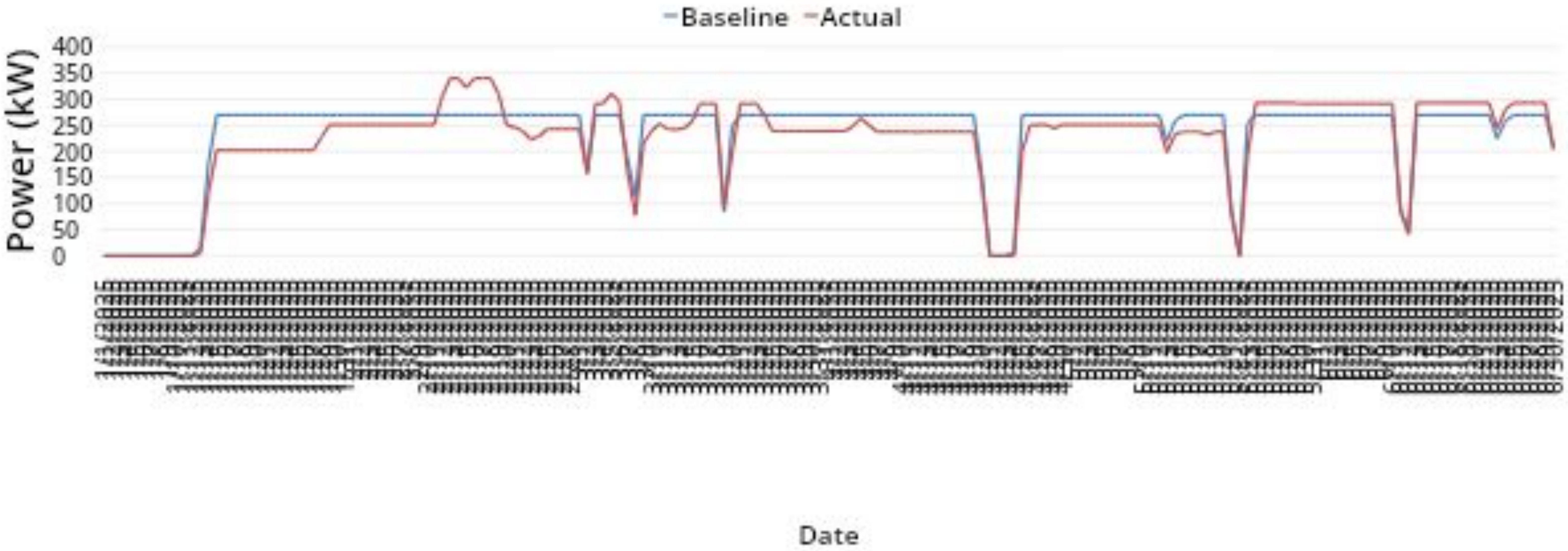


- **Key Test Results**
  - Initial proposal (1× GM130L + 2× GM60S): **Failed to maintain setpoint** — pressure dropped to 20 kPa
  - Revised configuration (1× GM130L + 3× GM60S): **Successfully maintained 35 kPa setpoint**
  - Confirmed operators were adding blowers unnecessarily while control valve was still venting

Case Study A – Implementation

- **Root Cause of Shortfall**
  - Possible leaks, worn motors, or blocked air intakes
  - Actual capacity lower than OEM performance curves
- New SOP: Add blowers only when blow-off valve fully closed

Case Study A – Implementation



- Savings to July 2025: R80,000 (below target)
- Main challenges: Operators restarting unnecessary blowers at shift changes; equipment failures
- Operator KPIs prioritize production stability over energy efficiency

Summary of case studies

Case study	Blower configuration	Pressure setpoint (kPa)	Analysis findings	Implementation outcome	6-month savings (as of 1 July 2025)	Key lessons learned
A	1 × GM130L 5 × GM60S	30–35	Historical data showed air supply consistently exceeded demand, with high blow-off valve activity. Based on OEM curves, 1 GM130L + 2 GM60S should theoretically meet demand.	Site tests demonstrated that this combination could not maintain the setpoint; 1 GM130L + 3 GM60S was required instead. A baseline operating profile was developed, although operator behaviour sometimes limited savings.	R80 000	Blow-off valve position is a valuable indicator of oversupply, but it does not directly quantify air wastage. Operator alignment with efficiency targets is critical.
B	7 × GM90S	56	Average demand was significantly lower than supply; calculations suggested 5 blowers should suffice. However, pressure stability problems and suspected leaks forced higher utilisation.	Tests confirmed 6 blowers could maintain pressure once leaks were partially addressed. Leak audits improved performance and allowed the plant to avoid unnecessary use of all 7 blowers.	R170 000	Air leaks can distort perceptions of demand, leading to excess blower use. Regular audits are essential to enable operation with fewer blowers.
C	6 × GM80L of mixed motor sizes: 2 × 132 kW 1 × 185 kW 2 × 110 kW 1 × 132 kW.	53–55	Analysis indicated demand could be met by 3 blowers. The 185 kW unit was often run instead of more efficient options. OEM data showed each blower delivered ~82.5 m^3/min.	Site testing confirmed that 3 blowers (preferably 1 × 132 kW + 2 × 110 kW) could meet demand under most conditions. A new prioritisation sequence was introduced to favour smaller units.	R750 000	Proper sequencing of blowers reduces energy use. Nameplate ratings may be inaccurate; auditing installed motor sizes can reveal hidden optimisation opportunities.
D	3 × GD 2400 centrifugal blowers	65	Two blowers normally operated. Blow-off activity was high, and surge control was inactive with the setpoint incorrectly configured (34.35 kPa vs. OEM 29 kPa).	Surge control was re-enabled and reset to OEM specification. This reduced blow-off activity and improved pressure stability. Further optimisation is possible through improved surge management.	R1 000 000	Correct surge control configuration improves both stability and efficiency. Manufacturer design specifications should be verified and restored when deviations are found.

Conclusion

- **Study Objective**
  - Reduce blower energy consumption without impacting production
  - Low-risk, data-driven approach using classical analysis and controlled site testing
- **Key Findings**
  - All four sites operated with excess blower capacity
  - Blow-off valves frequently venting air while unnecessary blowers ran
  - Clear supply-demand mismatch masked inefficiencies in equipment selection, controls, and maintenance
- **Implemented Solutions**
  - Refined pressure setpoints and optimized blower combinations
  - Prioritized operation based on motor efficiency
  - Enabled surge protection

Conclusion

- **Results Achieved**
  - **R2 million saved** across 4 sites (Jan–July 2025)
  - **R4 million projected** for full 12-month period
  - Zero impact on flotation performance or plant stability
- **Critical Success Factors & Limitations**
  - Instrumentation accuracy and data reliability challenges
  - Operator behavior alignment essential—KPIs often prioritize production over energy efficiency
  - Clear SOPs and operational involvement crucial for sustained results
- **Broader Impact**
  - Replicable methodology for platinum sector and wider mineral processing industry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