Improving compressed air system efficiency using Life of Mine planning

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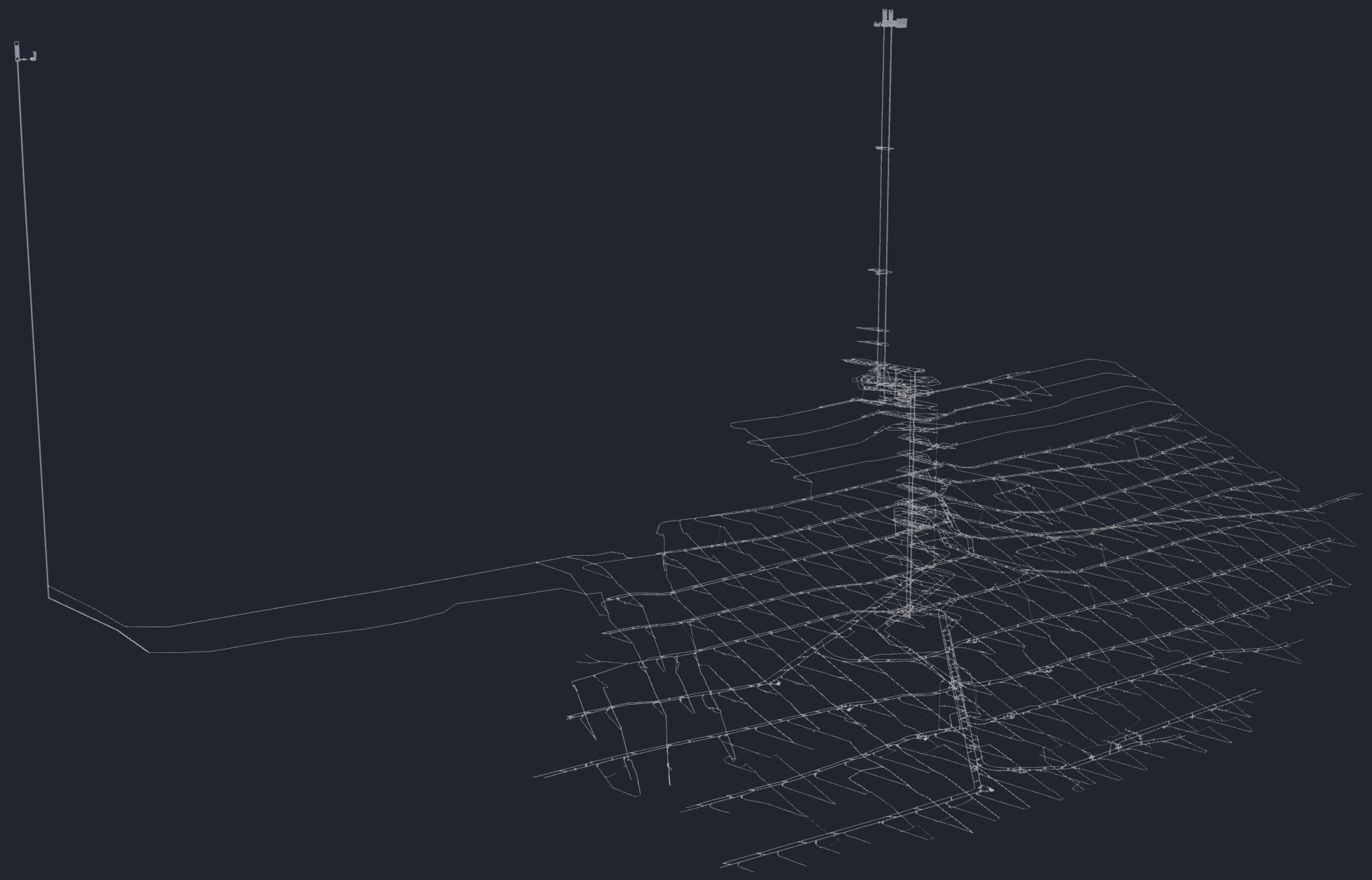

Presentation layout

- Introduction
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  - Mine layouts and planning
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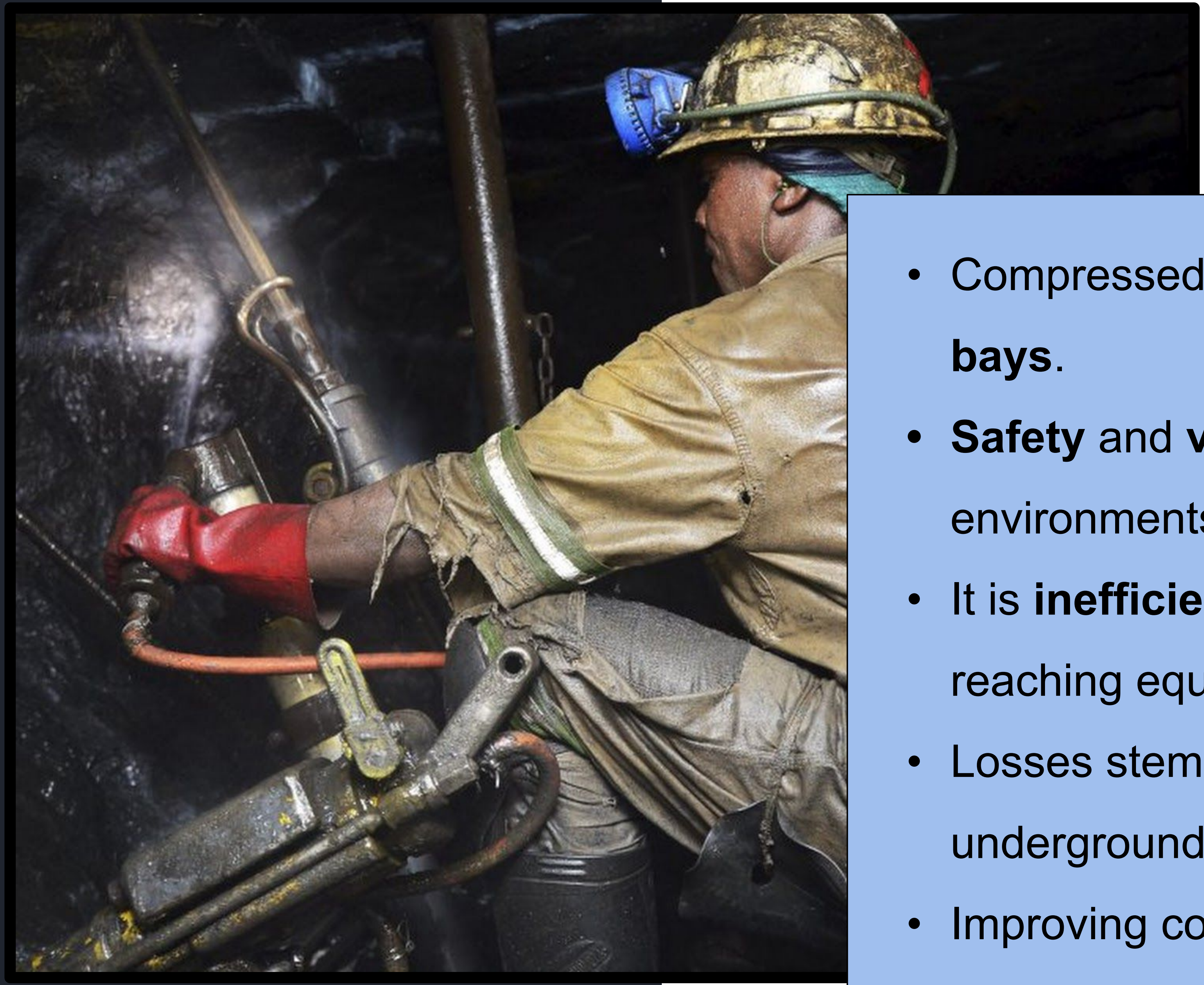
- Case study: Shaft A
- Case study: Shaft B
- Conclusion

Introduction:
General background

- South Africa supplies **~73%** of global platinum-group metals, making mining vital to the economy.
- Rising electricity tariffs, carbon taxes, and declining ore grades threaten profitability.
- Energy management is now essential for competitiveness and compliance.
- Compressed air systems consume **18–38%** of mine electricity and are highly inefficient.
- Compressed air losses from leaks, friction, and poor control cause major energy waste.

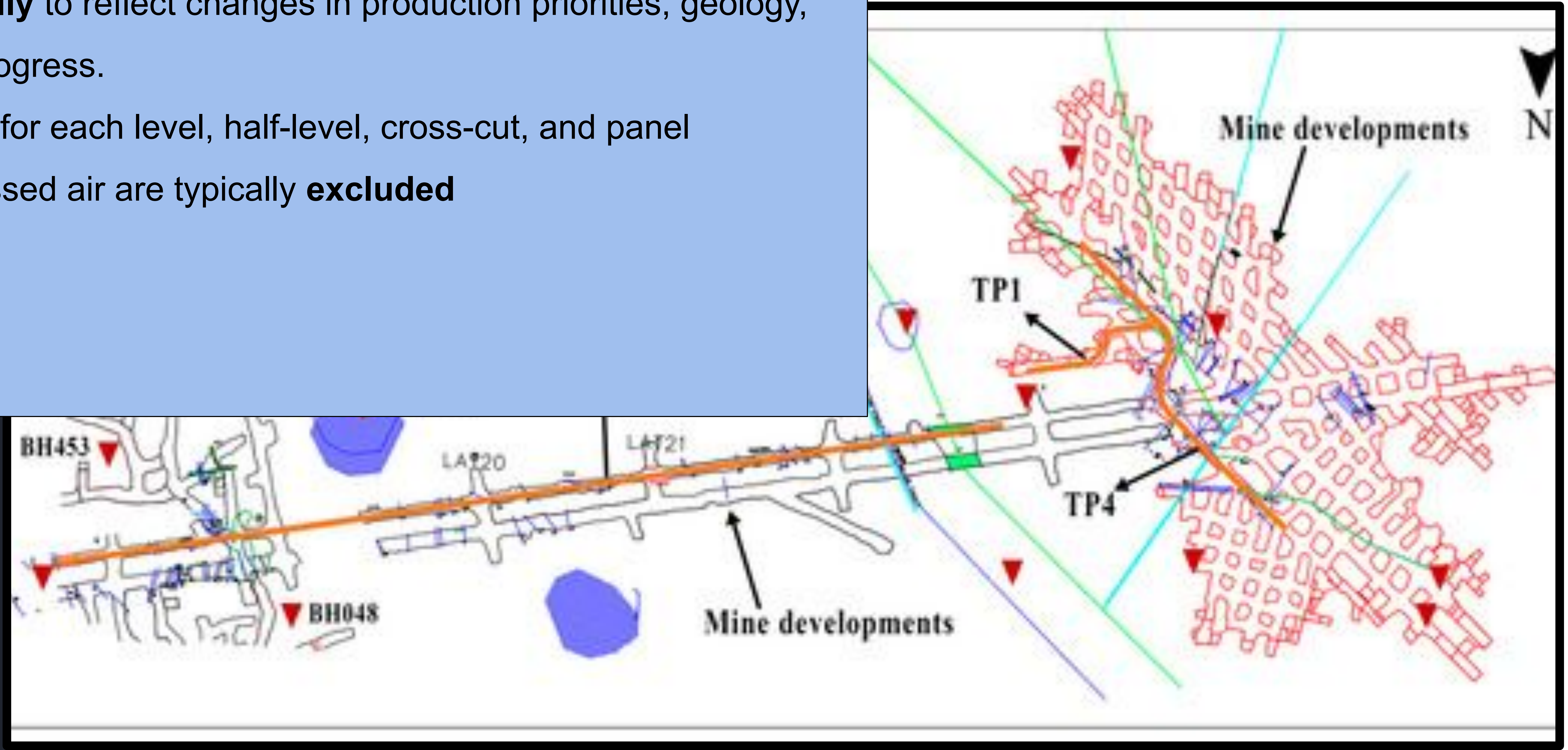
Introduction: Compressed air



- Compressed air is used for drilling, loading, debris clearing, and **refuge bays**.
- **Safety** and **versatility** makes it essential in deep, methane-prone environments.
- It is **inefficient** and costly, with over 70% of generated air lost before reaching equipment.
- Losses stem from friction, heat, leaks, and open pipe ends in long underground networks.
- Improving compressed air efficiency offers high returns on investment

Introduction: Mine planning

- A **Life of Mine (LoM)** plan maps the **full extraction schedule** of a mine
- It is **updated annually** to reflect changes in production priorities, geology, and development progress.
- Tonnes are planned for each level, half-level, cross-cut, and panel
- Utilities like compressed air are typically **excluded**



How can we use the the Life of Mine plan?

- LoM shows which sections are active, developing, or mined out.
- Use Life of Mine planning to find and isolate inactive areas.
- Align air layouts with LoM to supply only productive zones.
- Eliminates losses, improves stability, and boosts energy efficiency.

Development of solution

These steps can be applied to almost any mine:

1. **Identify inactive areas using Life of Mine planning**

2. **Audit inactive areas**

3. **Isolate inactive areas**

Using the Life of Mine plan, engineers can easily identify inactive areas. These may be the **lowest-effort** and **highest-impact** targets for energy savings.

Step 1: Identifying Inactive Areas

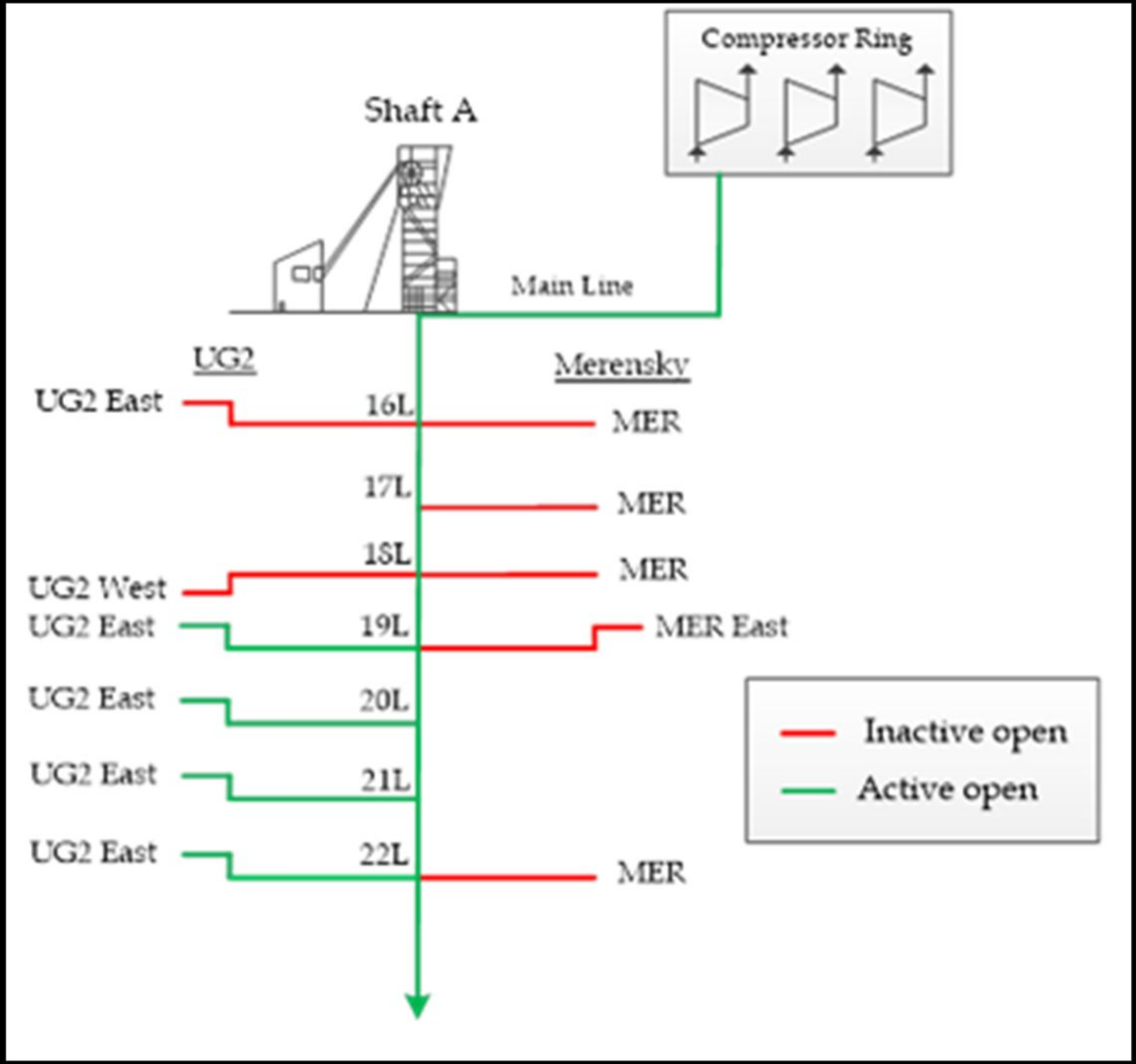
- Inactive areas have 0 tonnes planned or are excluded from the LoM plan.
- Confirm with shaft personnel if any work is still occurring.
- Ensures only non-productive areas are targeted, avoiding accidental cut-offs.
- Some zones may seem inactive but serve ventilation or reclamation purposes.
- LoM-based identification is a proactive, planning-driven approach to energy management.

Step 2: Auditing Inactive Areas

- Audits verify underground conditions in identified inactive areas.
- Teams walk air lines, checking valve and connection status.
- Targeted audits reduce time and effort while keeping accuracy high.
- Identify lines feeding inactive areas, causing constant air losses.
- Teams map and document leaks to guide isolation work.

Step 3: Isolating Inactive Areas

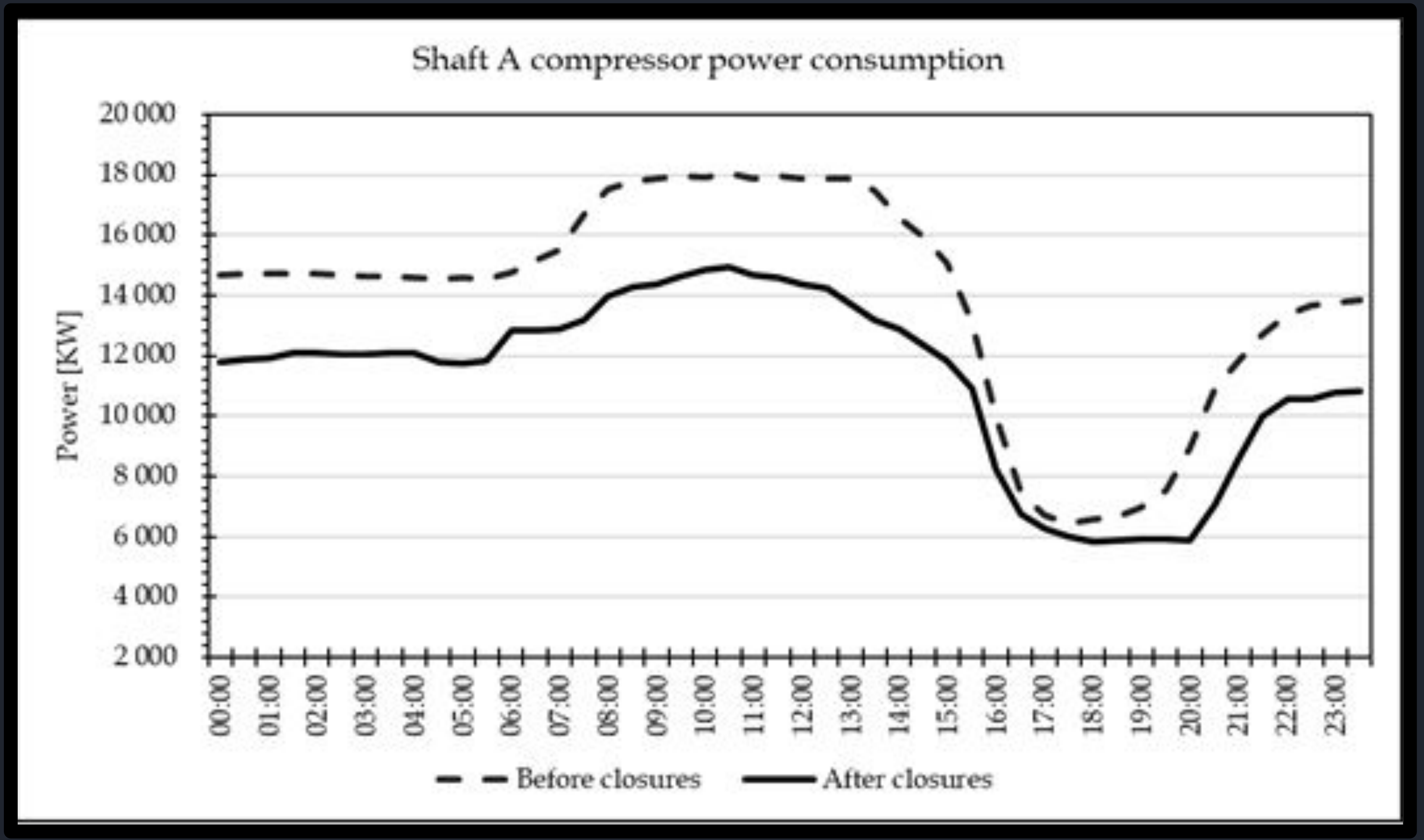
- Inactive sections are isolated from the compressed-air system.
- Blank plates or valves are installed at upstream flanges to stop airflow.
- Valves are used where future re-opening may be required.
- Work is done on non-production days under safe, depressurised conditions.
- Flow and pressure data are compared before and after isolation.
- Effective blanking improves pressure stability and reduces compressor load.



Case study: Shaft A

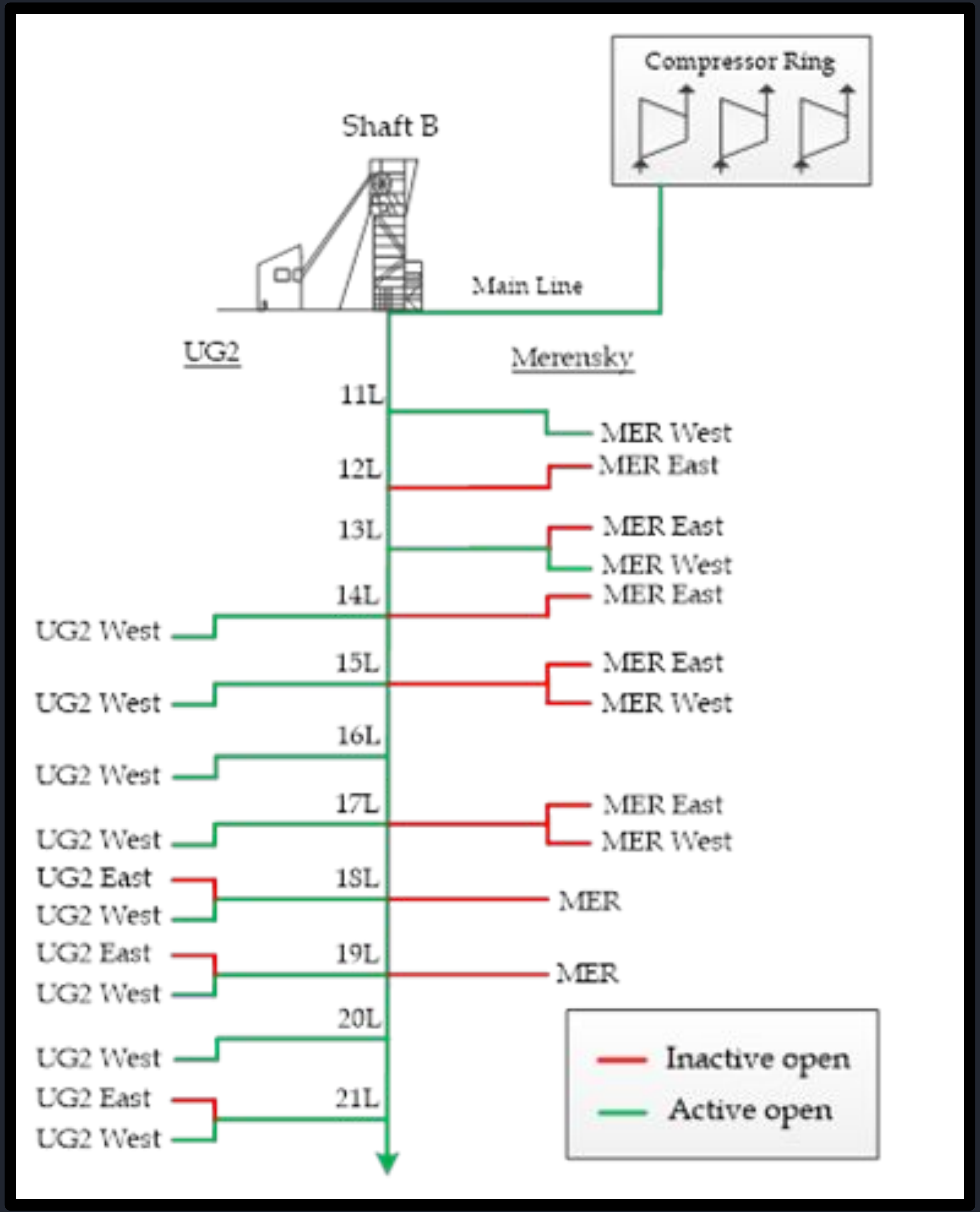
- LoM planning revealed seven inactive half-levels still connected to the air network.
- These sections were isolated over two months of controlled interventions.
- Air demand dropped by ~18%, matching estimated wastage from inactive areas.
- Production remained stable, confirming no impact on active zones.
- This showed that LoM-based targeting achieved major energy savings without reducing output.

Case study: Shaft A impact



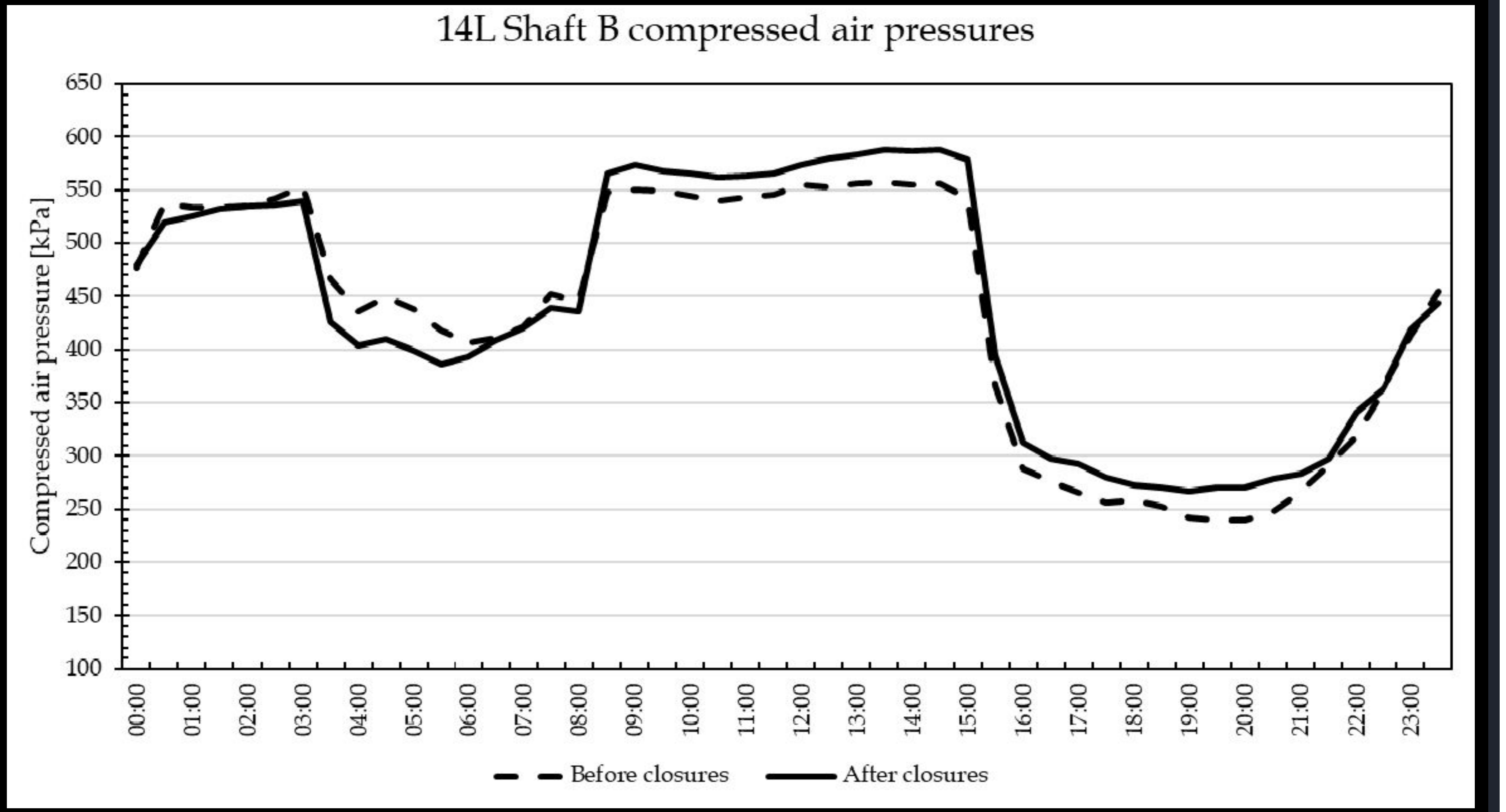
- Compressor power data showed reduced energy use matching the 18% airflow drop.
- The decrease equated to ~R32 million in annual electricity savings.
- No new infrastructure was needed, only isolating inactive areas.
- Production remained stable.

Case study: Shaft B



- LoM and audits identified 12 inactive branches still receiving air.
- After isolation, total airflow stayed constant, but pressure to active faces increased.
- Higher pressure improved drilling performance and ore output.
- Production rose by ~13% with no extra compressors or power input.

Case study: Shaft B impact



- Closing 12 inactive branches raised pressure by 18–36 kPa during peak drilling hours.
- The improved pressure enhanced drilling penetration and cycle efficiency.
- This directly increased ore tonnage by ~13% without added energy input.

Conclusion and Future Work

- Mines waste energy by supplying compressed air to inactive areas.
- Life of Mine planning can be used to identify and isolate these sections.
- At Shaft A, isolation reduced airflow by 18% and saved about R32 million annually.
- At Shaft B, pressure improvements increased production by roughly 13% without extra energy use.
- The method proves effective for improving both energy efficiency and production performance.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