

BARRICK Africa & Middle East

Kibali Automation Technology Overview

NYSE : GOLD
TSX : ABX

World class mines.
World class people.



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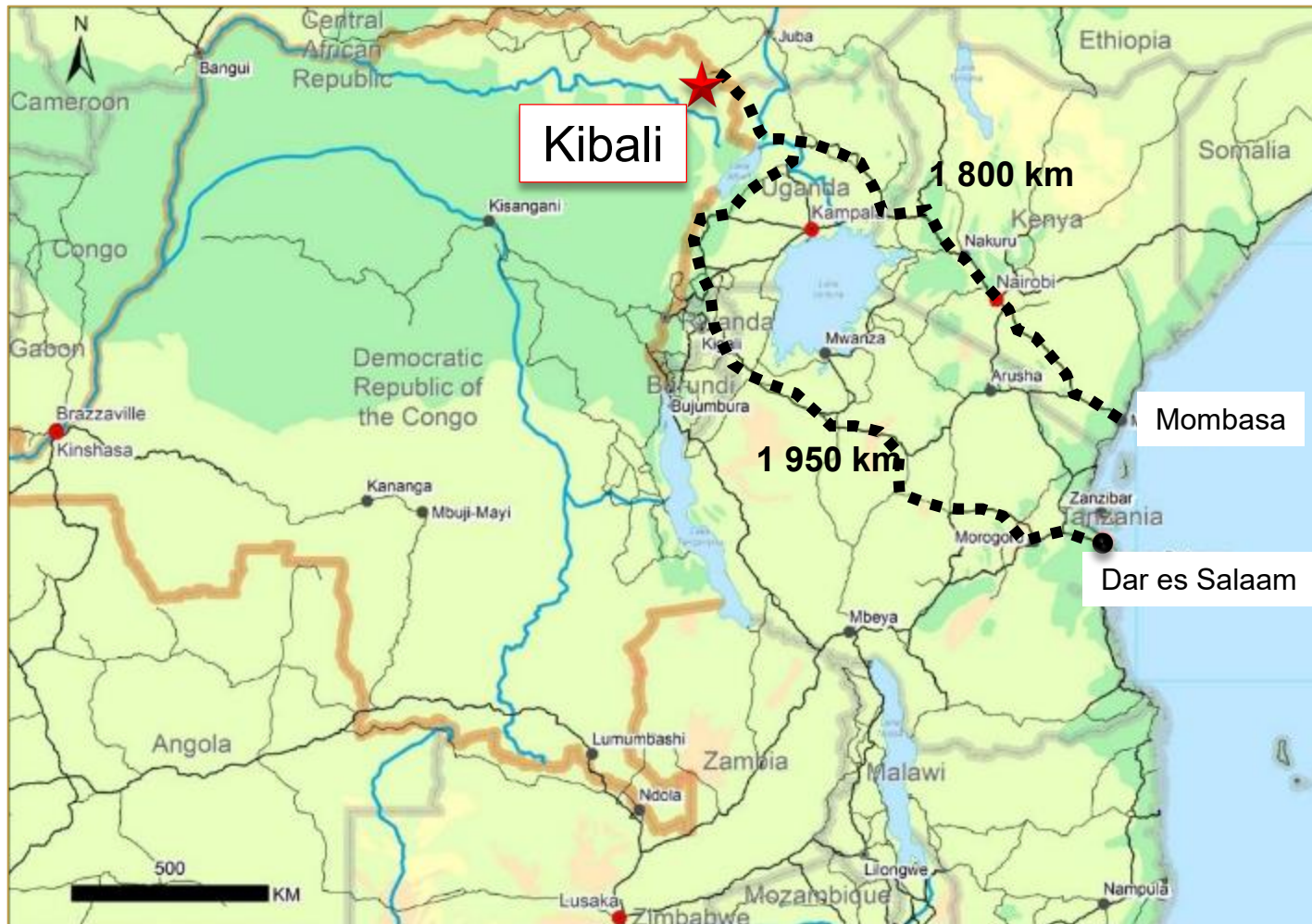
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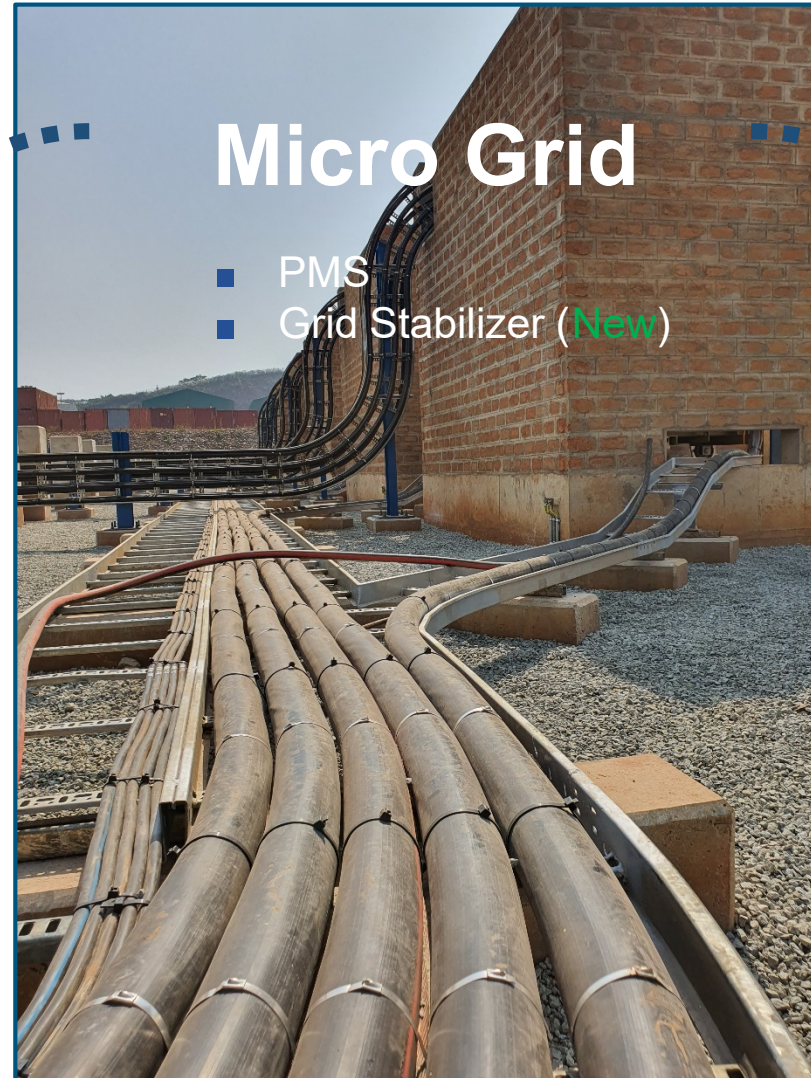
Where are we?

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Systems overview ...

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Micro Grid

- PMS
- Grid Stabilizer (New)

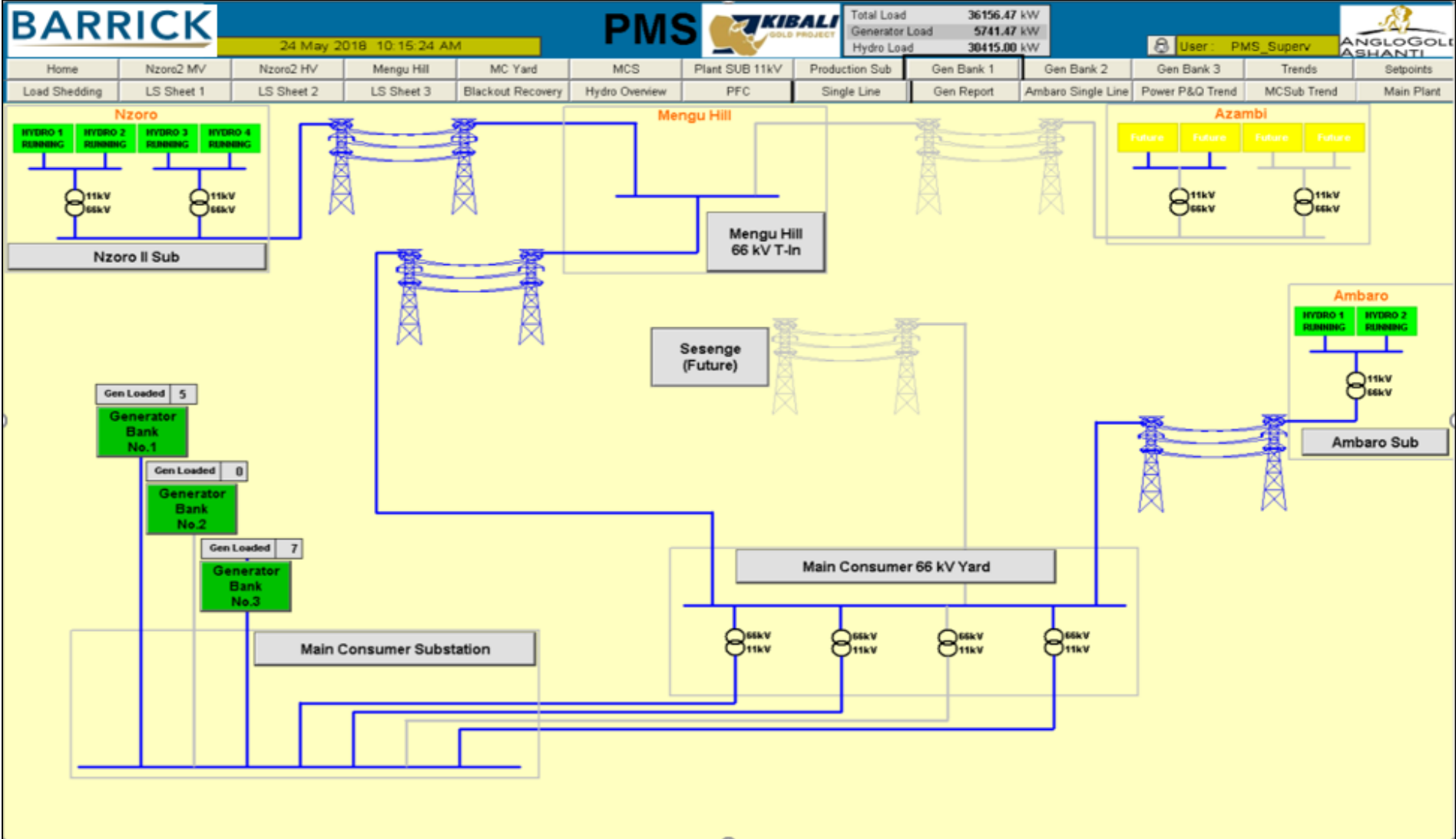
Underground

- ALS (AutoMine Loading System)
- MHS (Materials Handling System)
- Newtrax (New)

Plant

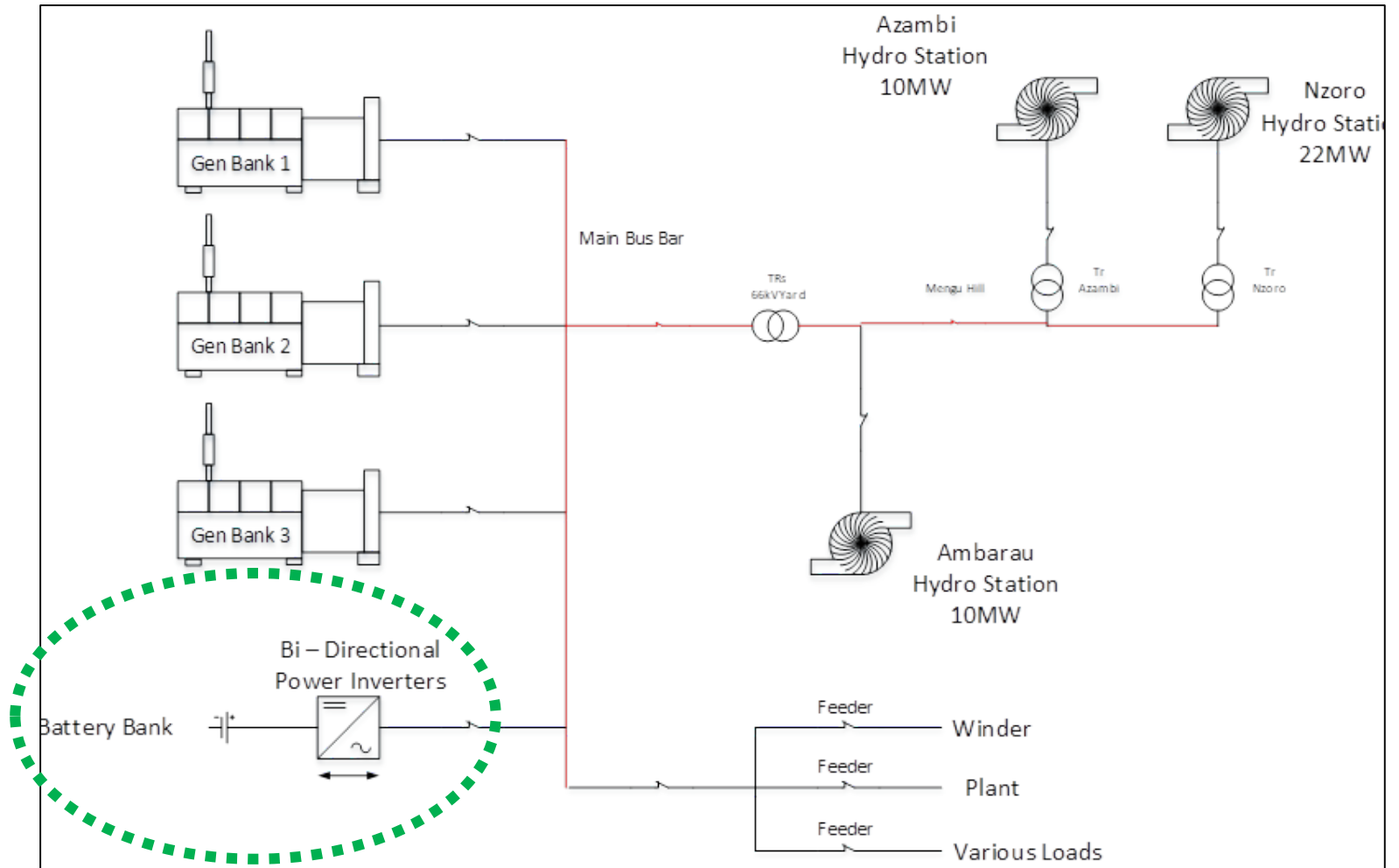
- Floatstar & Leachstar
- MillScanner
- Online Particle Size Analyzer (New)

Power Management System...



Kibali Micro Grid...

- Electricity demand is approximately 40MW
- Three high speed generator banks (32MW). Thermal generation of power (diesel, high speed) costs \$0.35/kWh
- Yearly average of \$0.11/kWh is achieved thanks to the hybrid system using gensets and hydro
- Mine demand varies continuously by up to 4MW on a 1.5 minute cycle due to the operation of the vertical shaft winder
- Batteries used as electrical storage to deliver 5 MW surge demand with Bi-directional inverter to manage our cyclic load that varies from 1.5 MW to 7.2 MW



Grid Stabilizer...

At present

The spinning reserve can be defined as a provision for cyclic loads of approx. 5.7MW from 1.5MW to 7.2MW, with a transient reverse power of 1MW

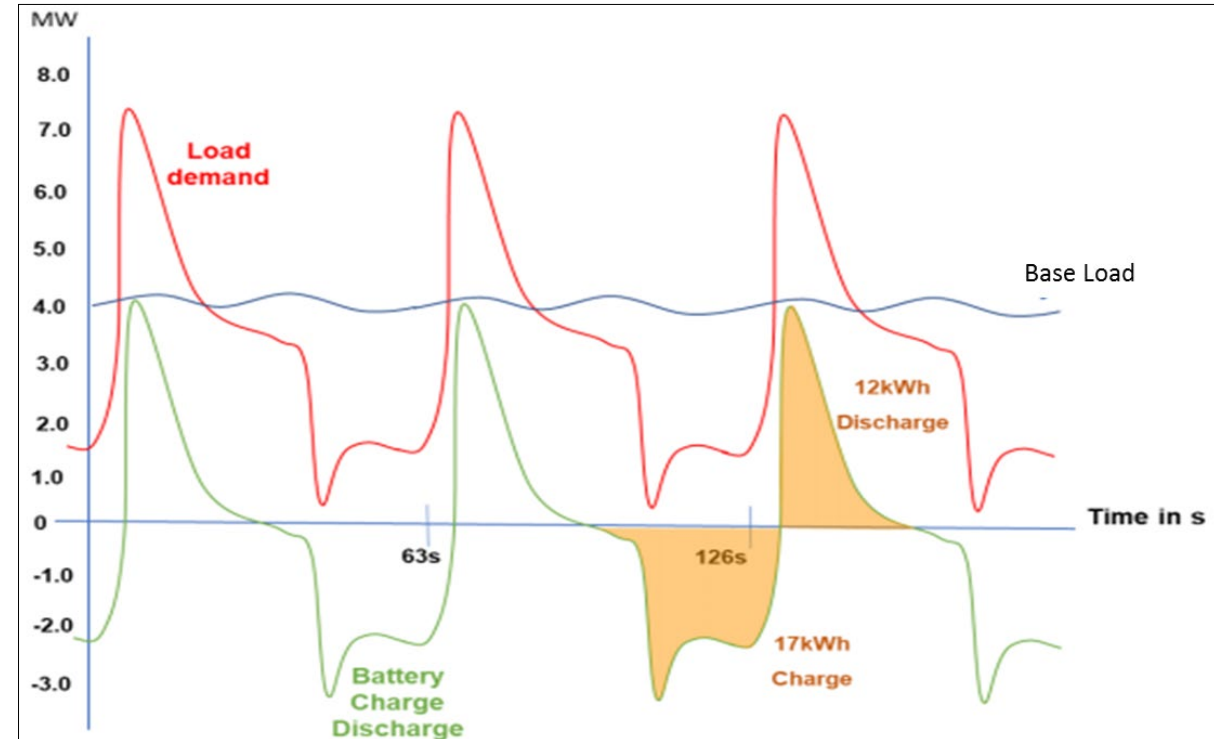
This spinning reserve is currently assumed by diesel power of approx. 8x 3512B Caterpillar gensets running permanently at low load (40%) and ready to accept a transient load impact (up to 100%)

Future (Quarter 2 - 2020)

Install a sufficient sized battery bank to achieve the following:



- Reduce the amount of gensets by half thereby reducing diesel consumption and maintenance
- To be able to supply the required load without increasing the number of gensets running but just increasing the average load output
- To charge batteries to an effective level so as to deliver the correct power demand from batteries



AutoMine Loading System...

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AutoMine (With Autonomous Loaders on Production Level)

Designed to have Autonomous SANDVIK LHD 621 loaders (20tons capacity) with an ALS (AutoMine Loading System)

The ALS Mission Control System is incorporated with below features:

- ❑ Traffic Management
- ❑ Auto-loading and tipping with real time TKPH (Tonne-Kilometres Per Hour)
- ❑ Real time bucket weighing system within 3% accuracy level for each bucket trammed to the COB (Coarse Ore Bin)



Automine Controlroom...

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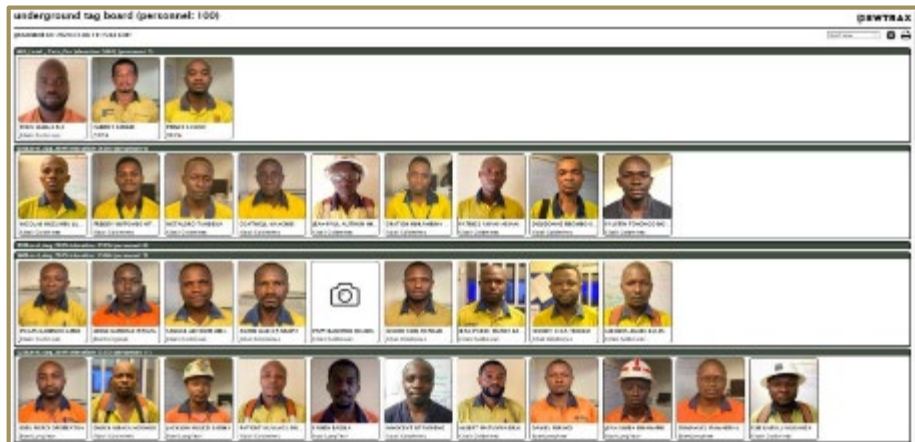
Newtrax...

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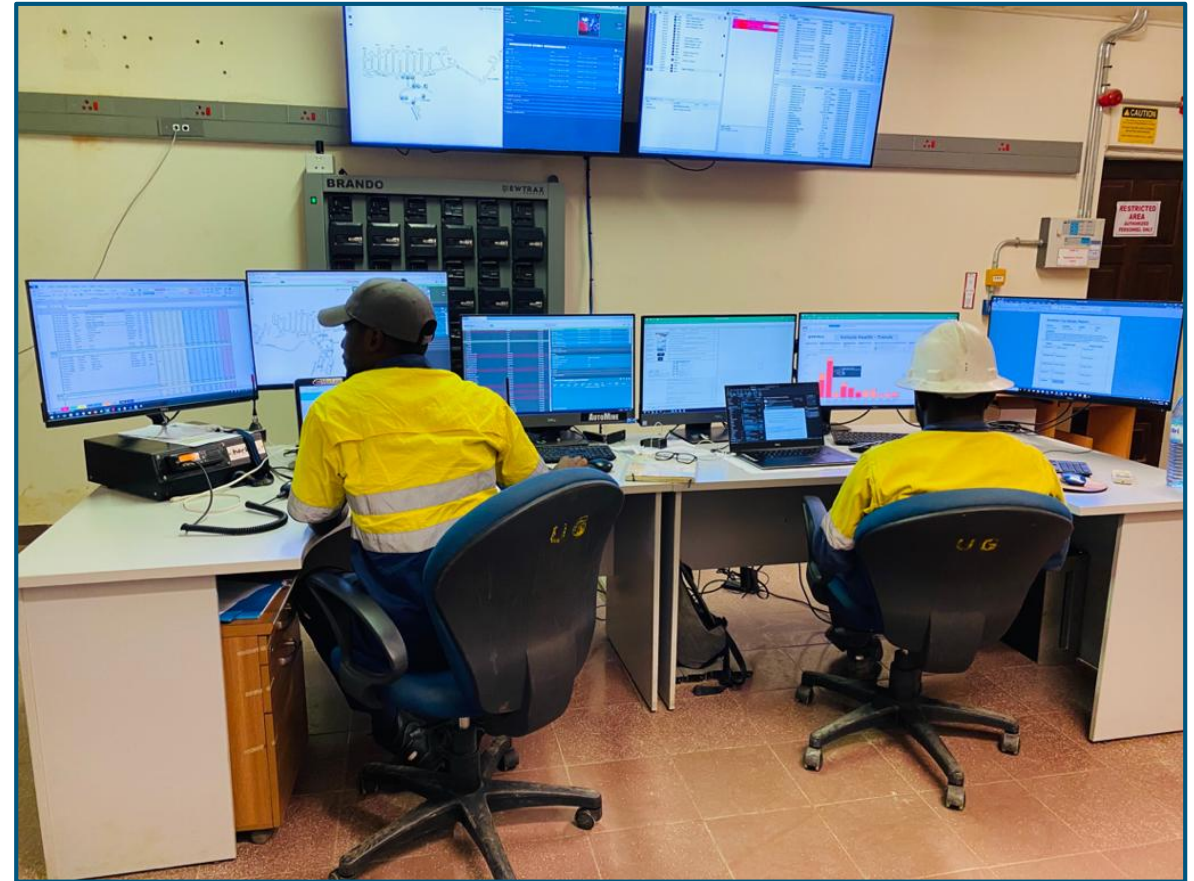
Objectives

Optimise Kibali Underground Mining by using Wireless IoT (Internet of Things) to gather data, treat them and target the sectors of mining below:

- People (Evacuation, Proximity Detection, Tracking, Distress)
- Environment (Ground & Gas Monitoring, Pumps and Fan Control)
- Machines (Productivity, Telemetry, Tracking, Face Utilisation)

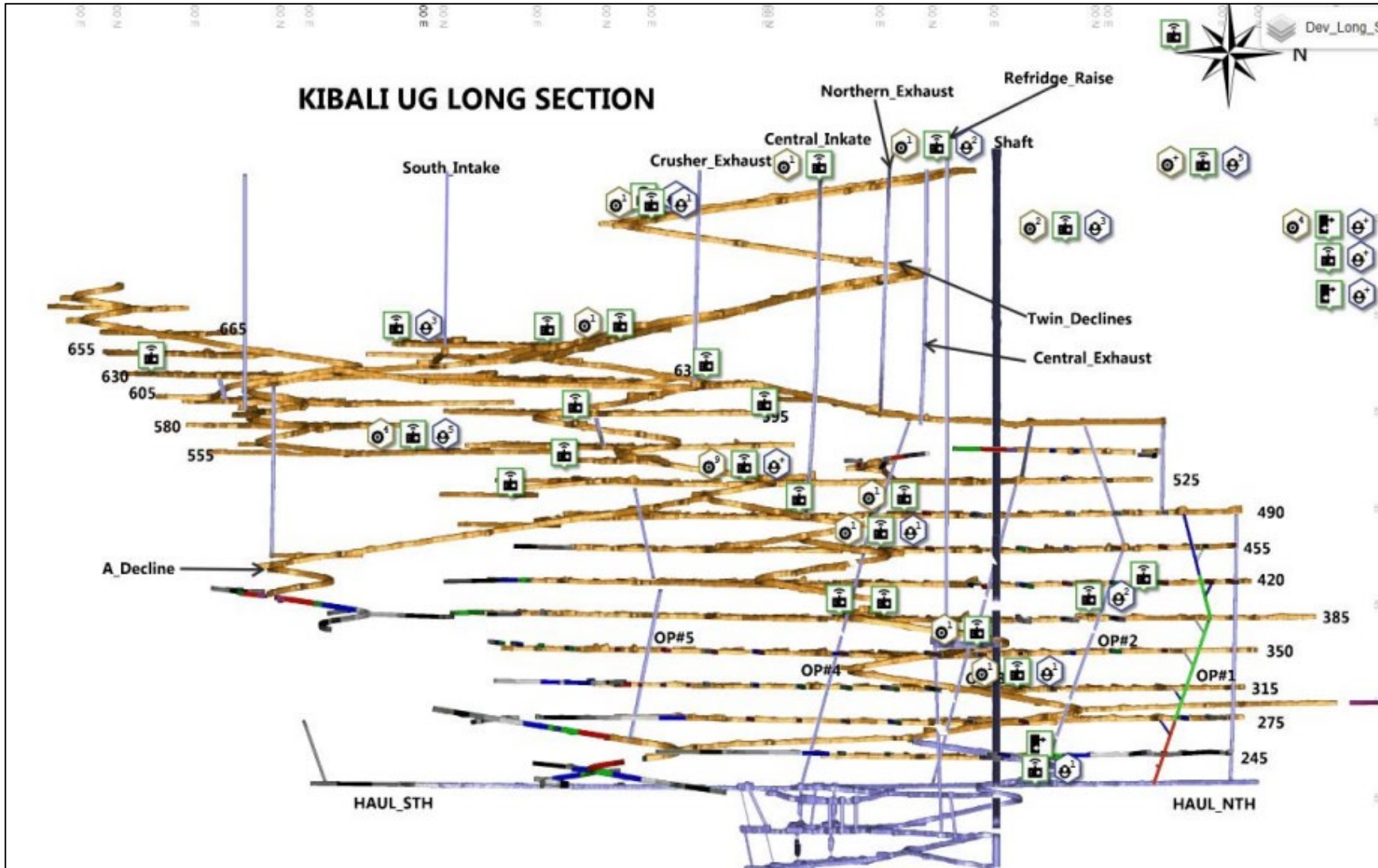


Electronic Tag Board



Newtrax...

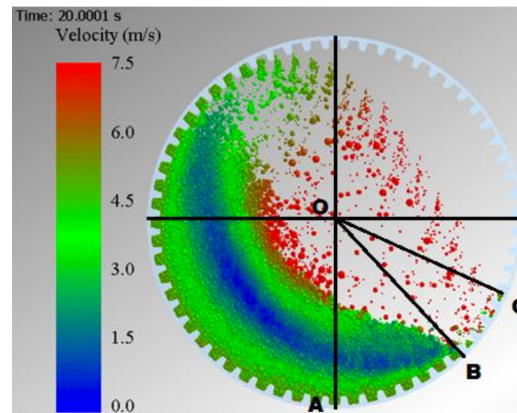
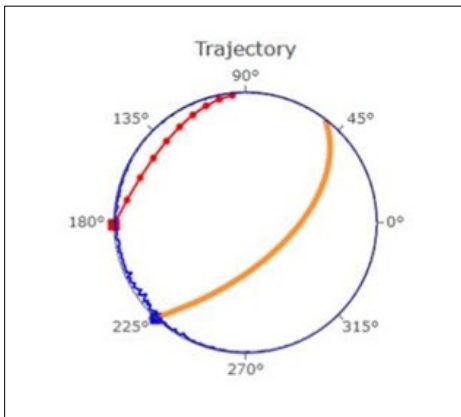
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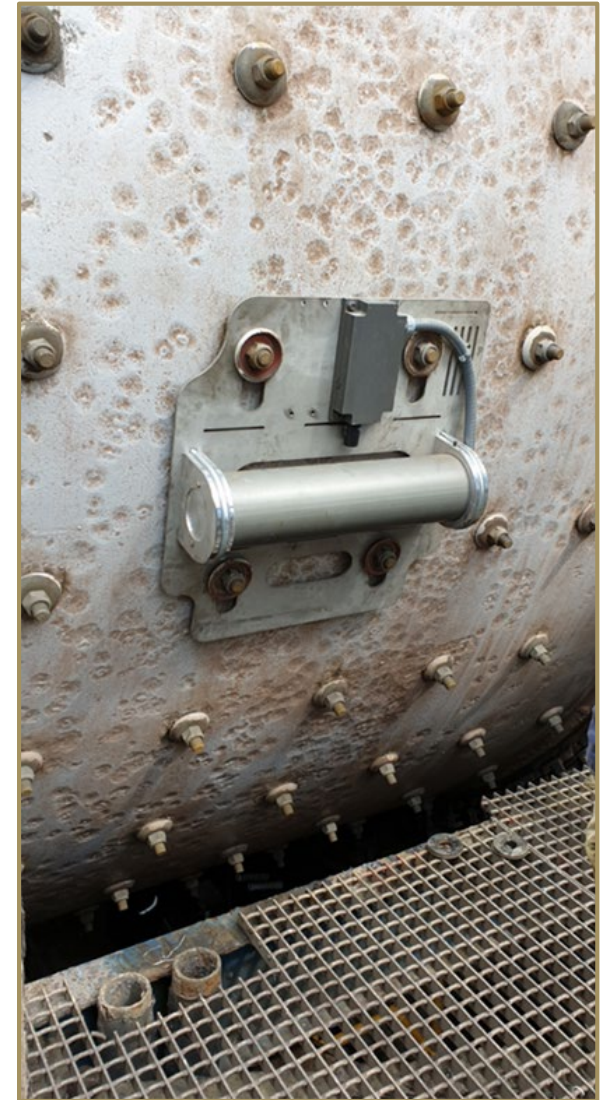
MillScanner...

The MillScanner is mounted on the Mill Shell and provides insights on what the conditions are inside the Mill

- Intensity: General indicator of Mill Loading conditions. This parameter helps improve liner life by managing the load
- Volume: Model setup to determine real time ball charge in each Mill. Value is used to ensure ball charge is at the correct level
- Throw and toe angle



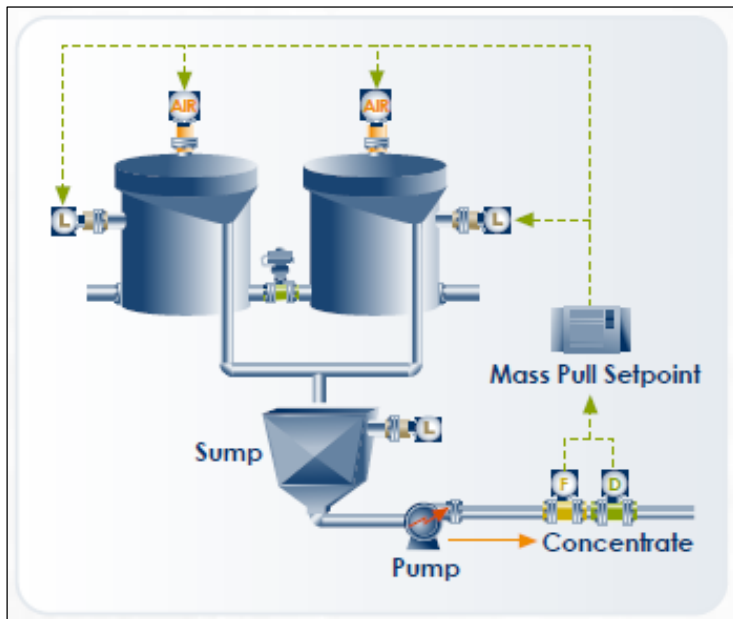
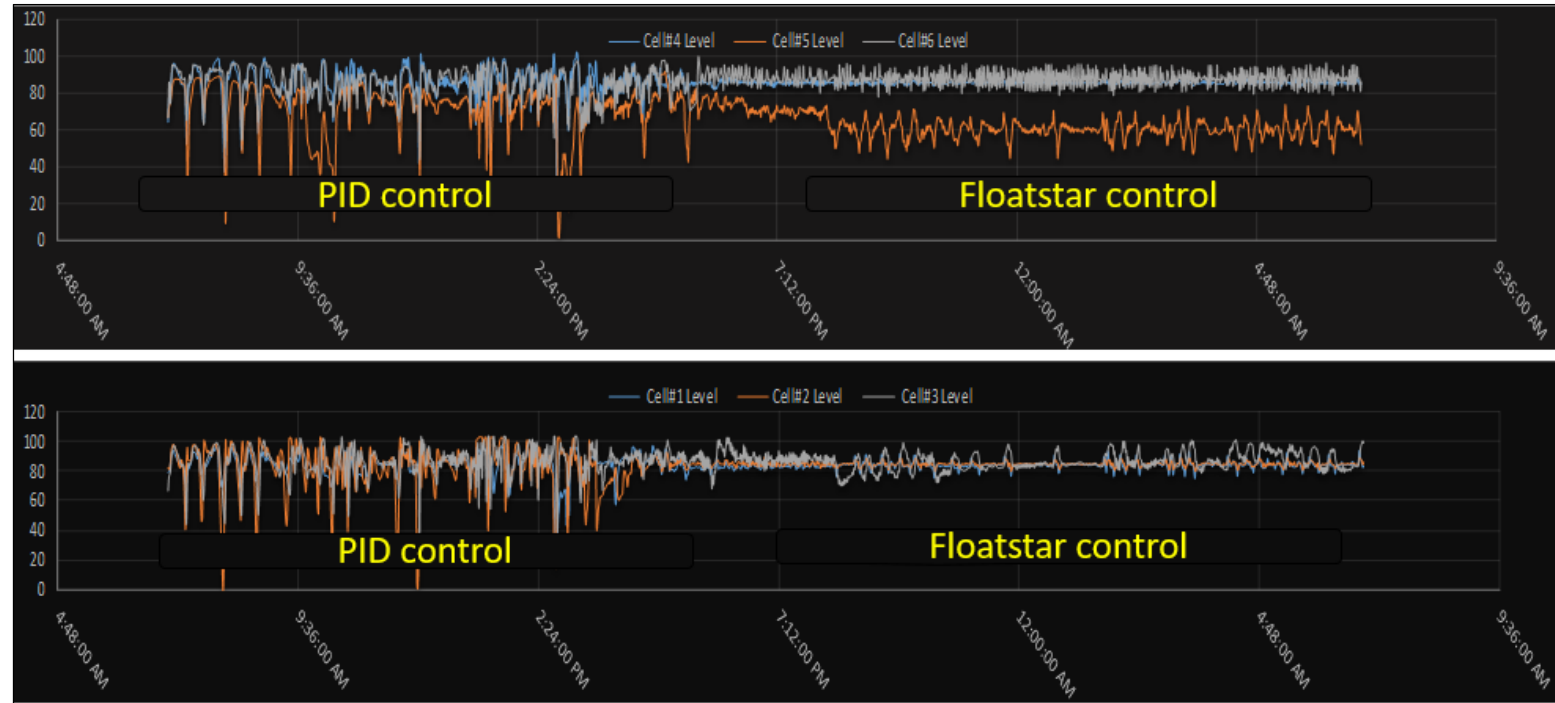
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Floatstar...

Flotation Recovery

- Improved recovery from 94.6% to 97.9% in 2019
- Improved flotation stability and performance
- Mass pull controlled based on setpoint (Air and level of cells adjusted to reach mass pull setpoint)



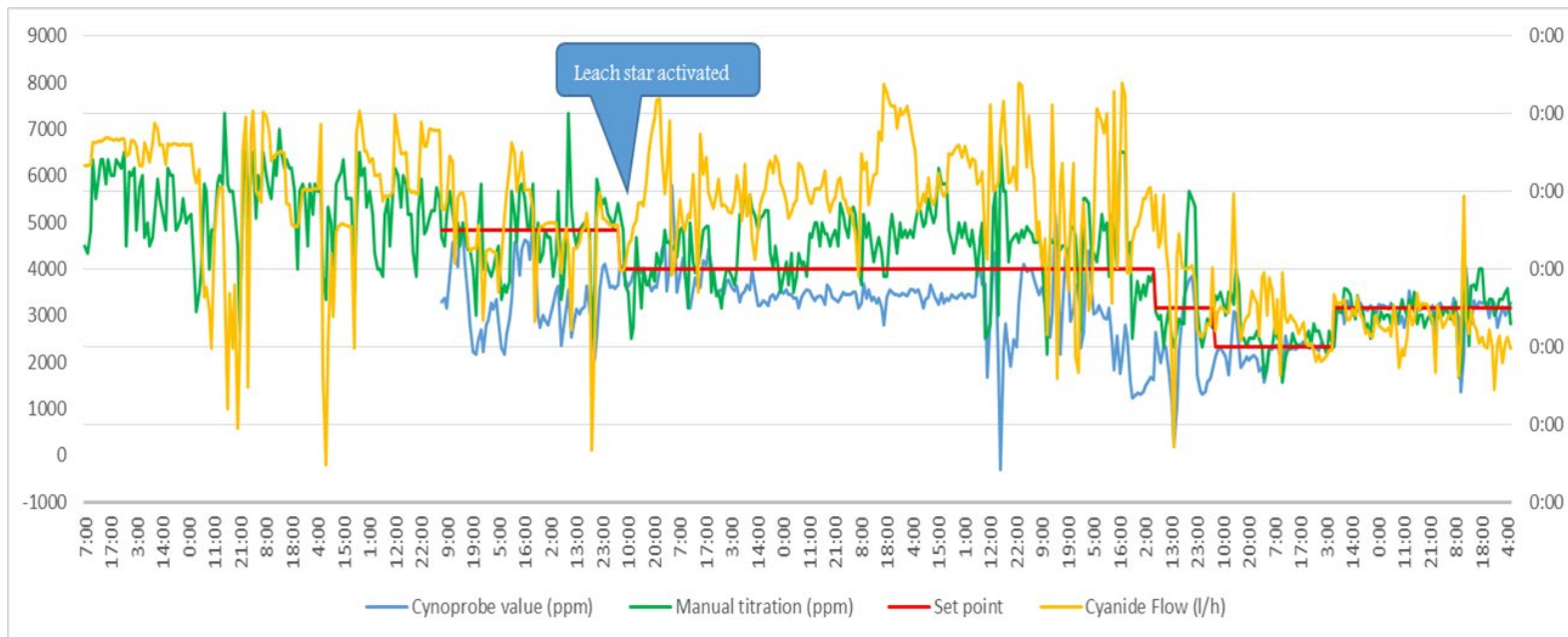
Leachstar...

Cyanoprobe

- Measures 'free' and WAD cyanide
- Measurement principle is based on the electrochemical amperometry
- Fast analysis time – 3 to 5 minutes

Leachstar

- Controls CN flow rate in the pumpcell circuit
- Uses CN concentration from Cyanoprobe and slurry feed rate to determine CN flow required
- Before Leachstar, CN was added at a fixed rate – causing overconsumption



On-Line Particle Size Analyzer (UFG Product)...

- New project – to be commissioned in May 2020
- To be placed on UFG product stream
- Measurement principle is ultrasound
- Real-time data of product grind
- Calibration done remotely 2 times per year
- Mastersizer used currently – results only available after 1 hour

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THANK YOU
