



MINING USER CONFERENCE, MAY 3-5, 2017

Vale S11D Case

World's largest iron ore mine fitted by ABB Ability MineOptimize

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Outline of presentation

Vale Company Overview

ABB presence

Vale S11D Project

Electrification

Extended Automation

Summary

Vale


The Vale is a private-sector, publicly traded company, headquartered in Brazil and present in around 30 countries around the world.

Created by the Brazilian federal government on **June 1st 1942**, with its operations restricted to the state of Minas Gerais.

In its first year, it produced 40,000 tons of iron ore, the same amount it now ships out per hour.

Privatized on May 6th 1997.

Production highlights 2016

 Annual record

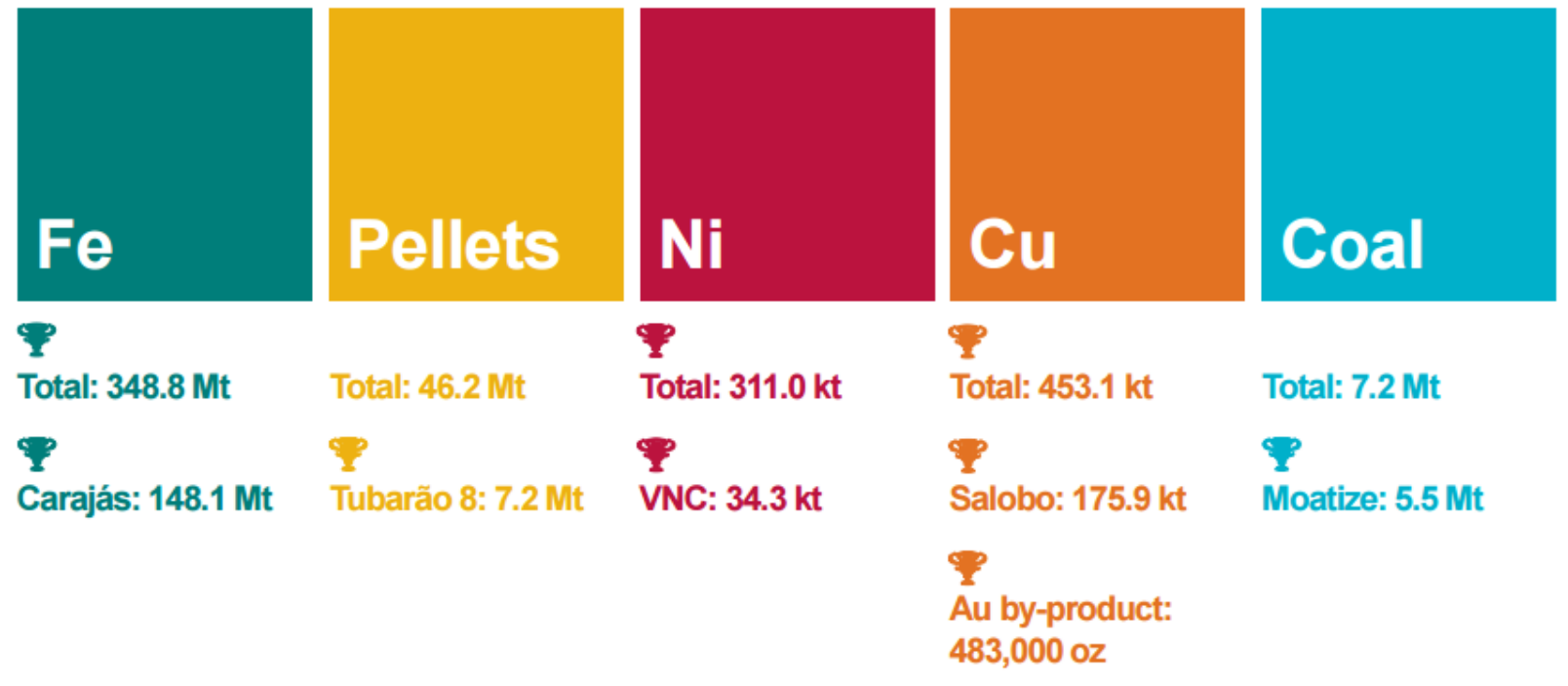
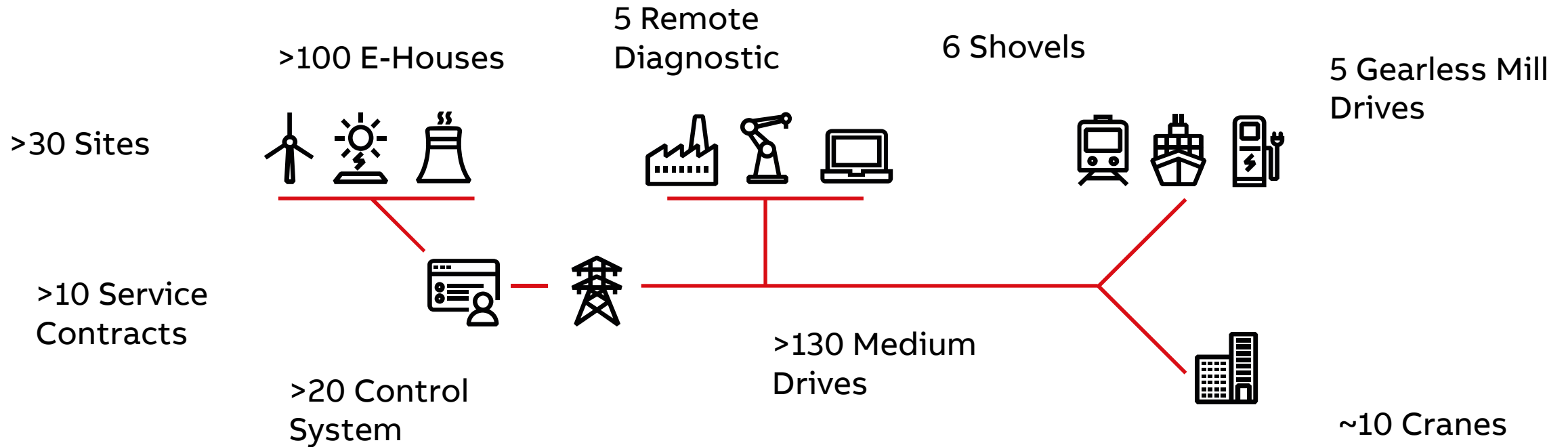


ABB covers the entire value chain from mine to market

Main Vale supplier for electrification and extended automation (estimated numbers)



Project Carajás S11D

The mining company Vale had an ambitious plan in the Carajás mountains of northern Brazil

In addition to a major capacity expansion, 90Mtpy

Build a sustainable mine of the future in the Amazon:

- Mine uses **truck less** mining – Shovels and mobile crushers working at the mine face and feed directly onto conveyor belts
- Beneficiation plant uses **dry ore processing** – ore from long belt conveyors to processing facilities and to train load



Redução de 93%
do consumo de água



Redução de 50%
das emissões de gases
do efeito estufa



Redução de 70%
do consumo de
diesel



Economia de
18mil
MWh/ano
de eletricidade por ano



Reutilização de
86%
da água captada



97% das
atividades
fora da área da
Floresta Nacional de
Carajás

Largest mining complex in Vale's history.

Location: Canaã dos Carajás – PA – Brazil

How ABB and Vale turned the challenges into real business value?



205.890 ton
Construction Material



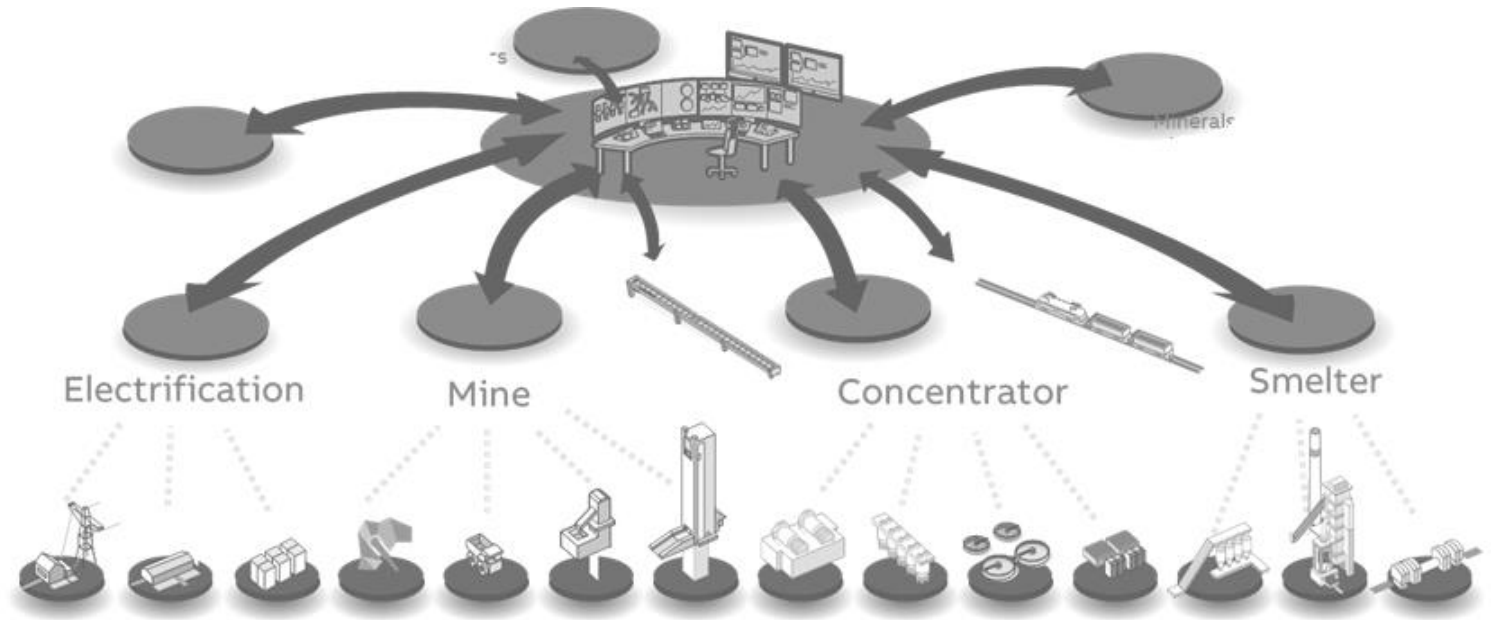
109 modules



66,7% of Iron
Concentration



+ 40.000 Workers
Since 2010



Bringing together people, equipment and services through digitalization

ABB Ability MineOptimize in Vale S11D

Totally integrated blocks for the mine, processing plant and transport to the market

Optimum CAPEX

Engineering

- FEED Studies
- Performance contractor
- Project Management
- Basic Engineering
- Commissioning
- Start up

Systems

- Integrated 800xA System power & process control
- 230 kilovolt in-feed substation
- 42 secondary substations
- High, medium and low voltage electrification, motors, and drives
- Main control room design and infrastructure

Optimum OPEX

Applications

- Power and process control libraries
- 3D KPI collaboration board
- Energy management
- Condition monitoring solutions & consulting
- IT / OT integration for advanced asset management

Services

- A new ABB Service Center in Carajás with workshop, parts inventory and a remote diagnostic
- Being close-by site and taking action immediately avoid costly production interruptions

Optimum CAPEX

Provide the foundation on which performance improvement and cost containment rely

Primary substation



E-House (88 units, ~173 modules)



Central Control Room

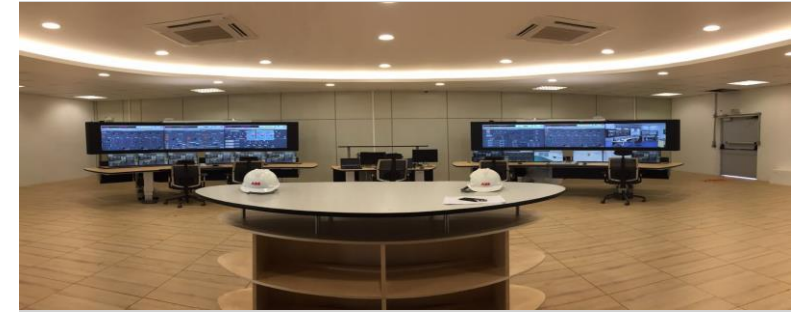


ABB Packages - Direct to Vale

Description	Quantity/Scope
Main E-house – Plant	230 kV (3x75 MVA)
Main E-house - Mine	230 kV (3x75 MVA)
Secondary E-house - Plant	25 E-house / 113 module
Secondary E-house - Mine	44 E-house / 60 module
Automation System - Plant	800xA
Automation System - Mine	800xA

ABB Packages - Via Sub Supplier

Description	Quantity/Scope
E-house - Long Distance Belt Conveyor	4 E-house
E-house - Train Load Out building	2 E-house
E-house on board – Sandvik Equipment	10 E-house
E-house on board – Krupp Equipment	3 E-house
Motors	126 units

Mine and beneficiation plant 230kV substations

System

Hybrid Module PASS 234kV

Gas isolated module - optimizes multiple devices in one, reducing space and increasing system reliability, reduce maintenance and downtime.

It is possible to provide energy to a city of 1,224,000 citizens, or 30 times the city of Canaã dos Carajás.

Installed base– 375MVA



Integrated electrification and automation package

System

Our integrated electrification and automation systems enables a truck-less system transport the iron ore from mine into the process plant.

With lower carbon emissions, reduced operating costs and greater safety than the truck-based



Take away message

Integrated mine and beneficiation control room

System

By eliminating the excess information, a new EOW - Extended Operator Workplace concept was used. Visualization in an integrated and organized way:

- Process automation
- Electrical automation
- Energy management
- Process cameras
- Fire system
- Asset management and alarms

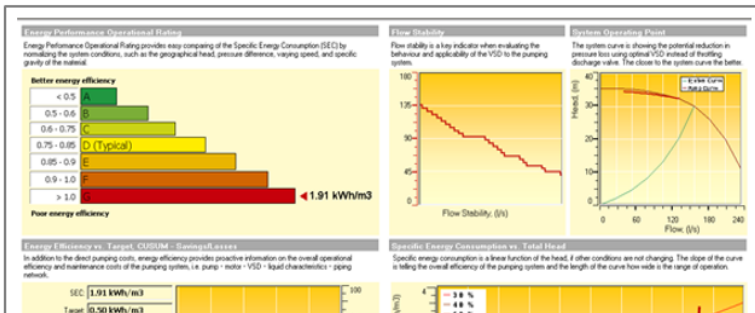
Operational Intelligence Center



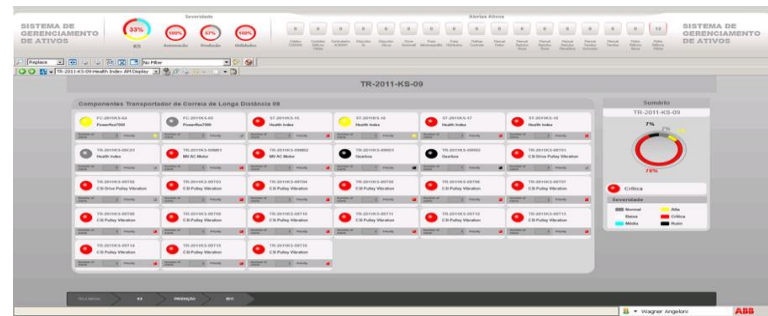
Optimum OPEX

Ensure that engineering and infrastructure investments continue delivering the desired results

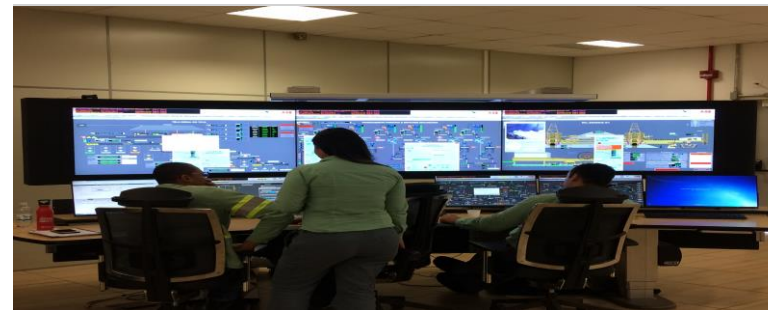
Energy Management



Asset Management



High level system



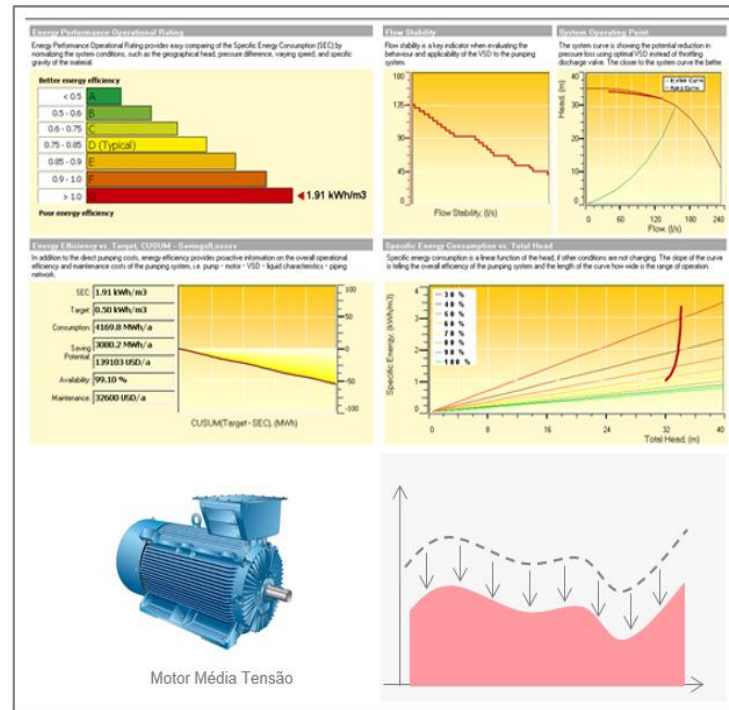
3D Collaboration Board



Integrated energy management application

Application

ABB Energy Manager is an ISO 50001: 2011 certified level 3 (ISA 95) management system that monitors the energy consumption of assets and process areas in real time, providing visual tools for quick decision-making and efficiency analysis of the plant.



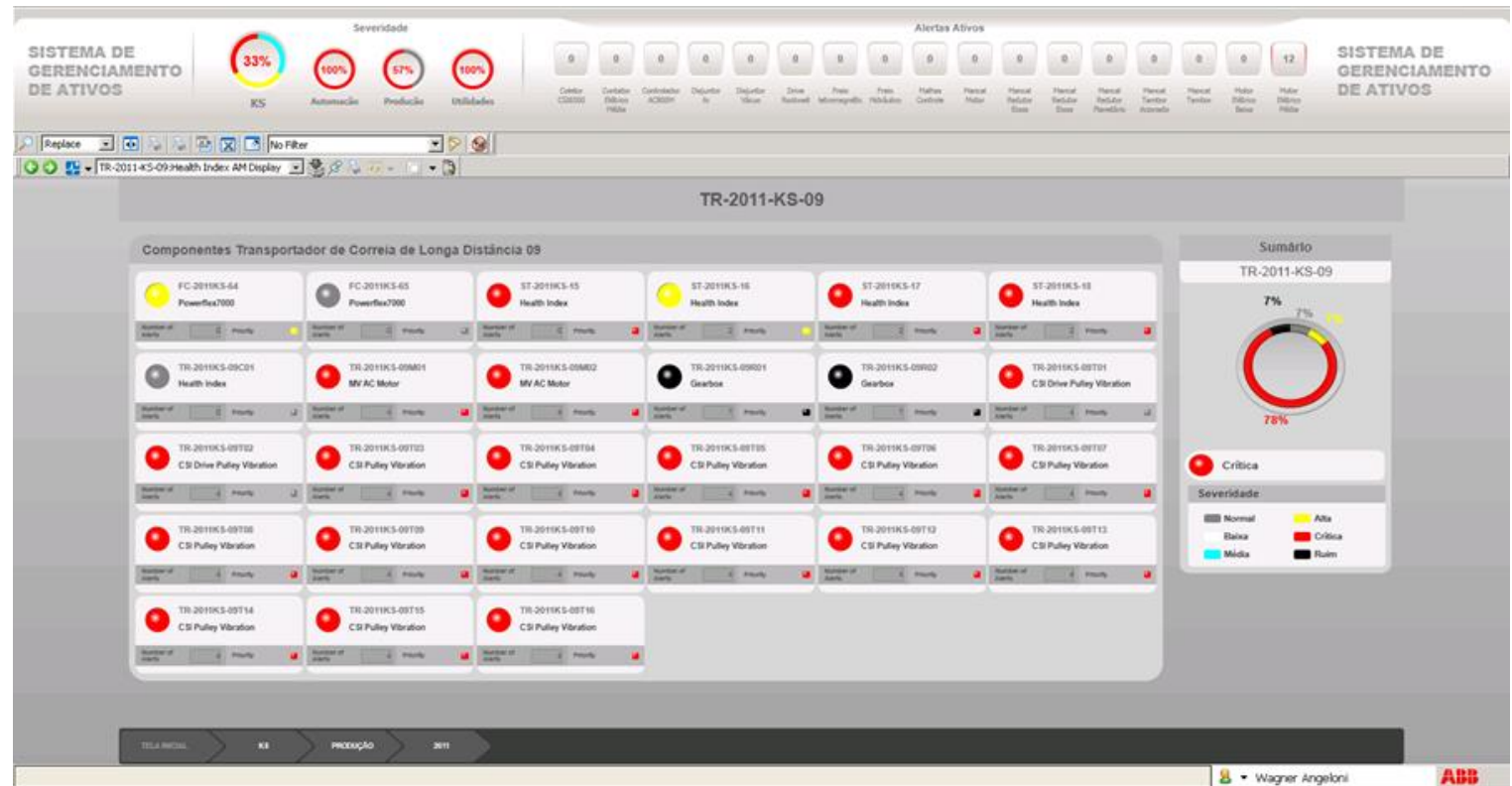
Process and power control

Integrated condition monitoring application

Application

A new condition monitoring system now monitors the health of 6000 production, electrical and mechanical assets in the process plant, reducing maintenance costs while improve equipment reliability and reduce unplanned shut-downs

Condition based maintenance



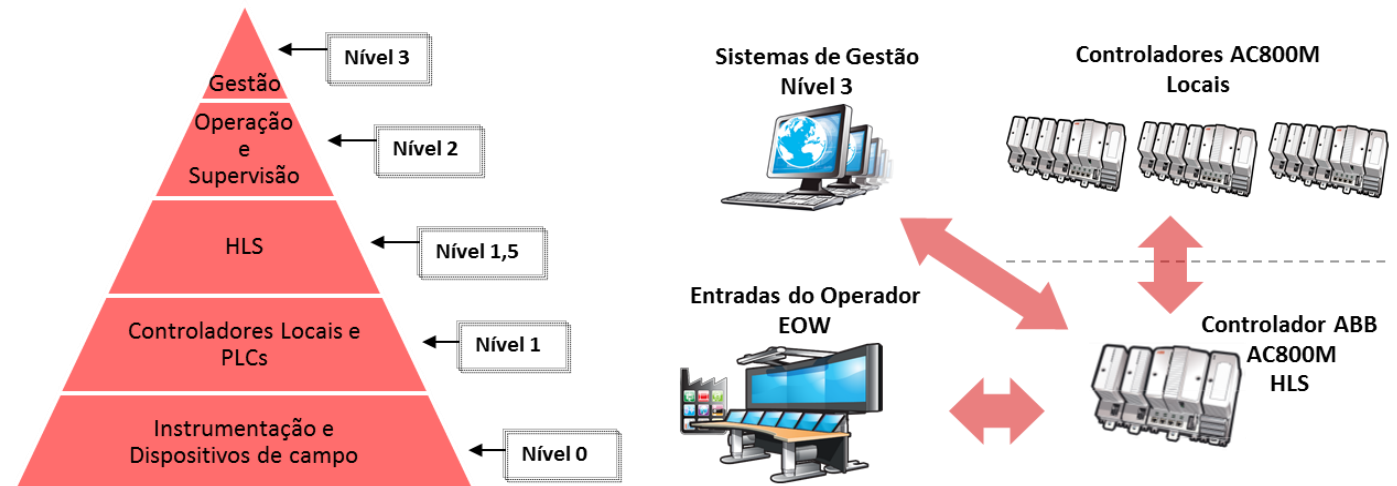
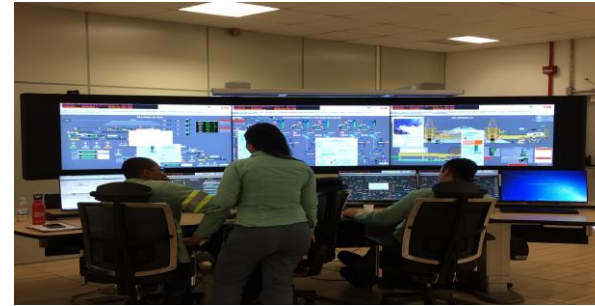
Integrated operation and advanced control

System

O *High Level System* (HLS) é um sistema centralizado de controle responsável pela operação geral dos equipamentos e instalações da planta do S11D tanto na usina de beneficiamento quanto na mina *truckless*.

- Plant Sequencing System (PSS) / Mine Sequencing System (MSS)
- Product Tracking System (PTS)
- Continuous Control System (CCS)
- Yard Management System (YMS)
- Collision Avoidance System (CAS)

Integrated advanced control



Integrated 3D operation view application

Application

Sys3DKPI provides the next level of plant operation with 3D environment. Main features:

- Zoom spots with detail models
- Floating KPIs per zoom spot
- KPIs with trends, videos, graphics
- Plant tours
- Subscribe to process data values from 800xA.

Operation and collaboration



High levels of visibility, agility and optimization across operations



Total mining performance, through digitalization

Summary

World's largest iron ore mine fitted by ABB Ability MineOptimize

Now world's lowest iron ore production cost

Dramatic increases in:

- Performance
- Predictability of operations
- Asset reliability
- Energy efficiency
- Health and safety
- Protection of the environment





ABB