

# **BRAZIL: MINAS-RIO AND NICKEL**

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Real Mining. Real People. Real Difference.

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## **ANGLO AMERICAN IN BRAZIL**



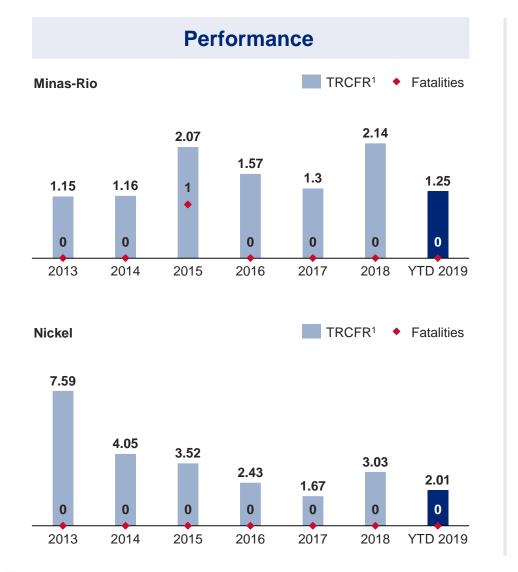


Iron Ore: Minas-Rio



Nickel: Barro Alto & Codemin

## SAFETY IS OUR PRIMARY VALUE



#### **Elimination of Fatalities**

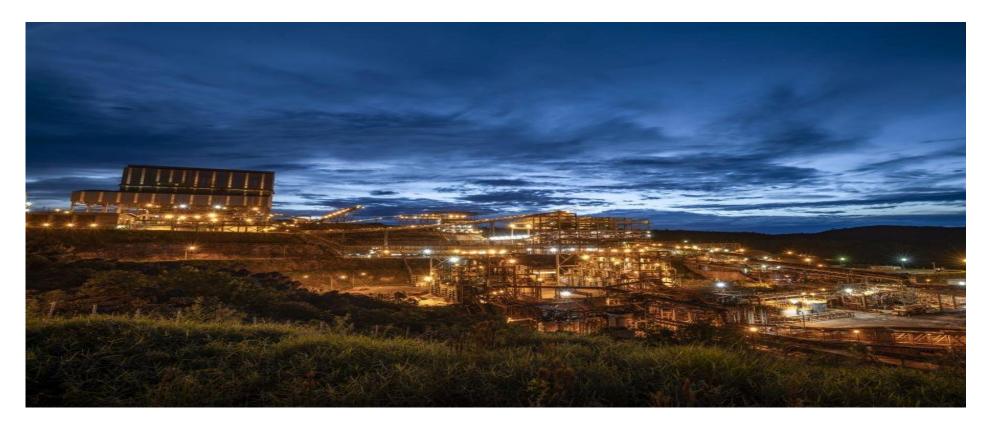


#### **Focus areas**

Cultural and behavioral change Mobile equipment - fatigue management Improving compliance, including contractors



# **MINAS-RIO**



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## **MINAS-RIO KEY MESSAGES**

## **Product quality**

67% Fe with low impurities

# Operational excellence

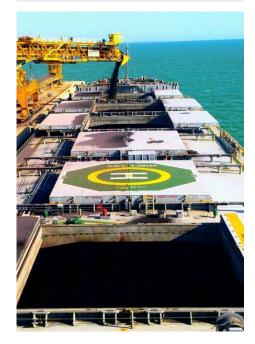
Strong ramp up

## 48 year mine life

3.2bt Ore Reserve<sup>2</sup>

## Strong local partnerships

Collaboration with authorities and communities









## **MODERN INTEGRATED BUSINESS**

## Mining





Export



Open pit

Low LOM strip ratio (0.2)<sup>3</sup>

32 Komatsu haul truck fleet<sup>3</sup>

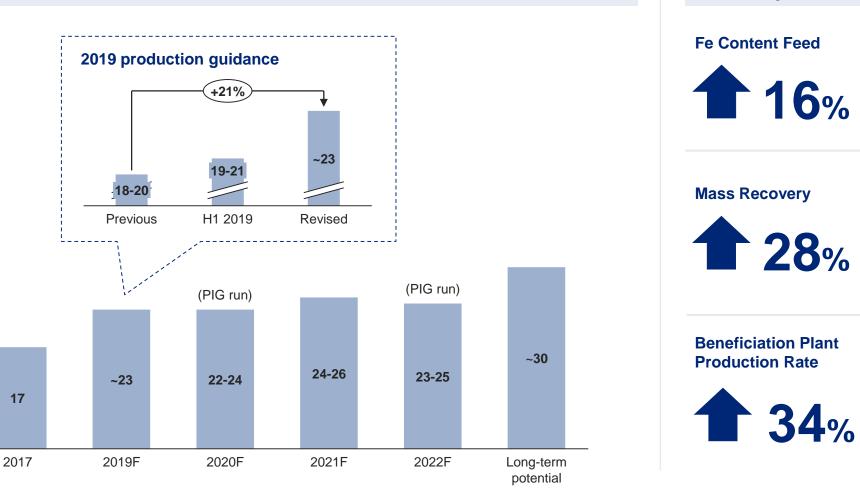
Crushing, screening, milling Desliming, grinding, flotation 38% Fe grade ore upgraded to 67% pellet feed product 529km export pipeline

JV managed facilities at Açu Port



## **MINAS-RIO OPERATIONAL PERFORMANCE**

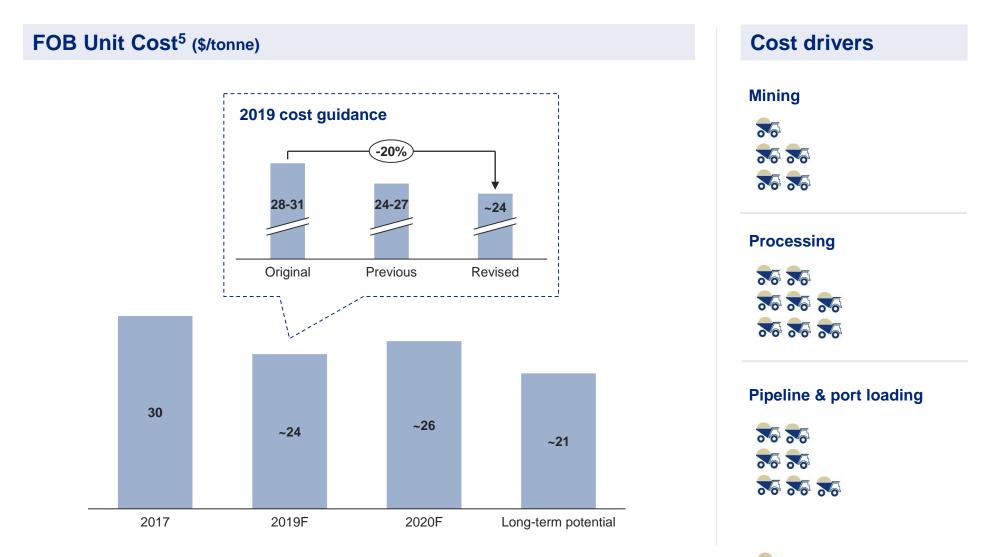
#### **Production**<sup>4</sup> (wmt)



AngloAmerican

**P101 improvement** 

## **MINAS-RIO OPERATIONAL PERFORMANCE**





9

## **QUALITY PRODUCTS SUITED TO FUTURE DEMAND**



Blast Furnace Pellet Feed 66-67% Fe (~65-70% of production<sup>6</sup>)



Direct Reduction Pellet Feed 68% Fe (~30-35% of production<sup>6</sup>)

Modern steel production focused on quality

**Bigger blast furnaces and tighter emissions standards** 

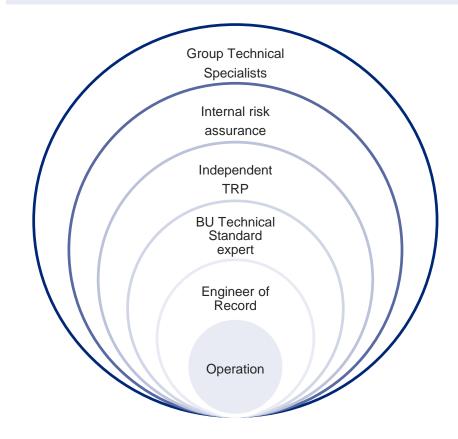


## **BEST-IN-CLASS TAILINGS MANAGEMENT**

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State-of-the-art monitoring: 16 Water level indicators 11 Piezometers 2 Internal drainage flow meters 1 Total monitoring station (24h x 7days) Orbital satellite INSAR 4 Sirens - 12km downstream of the dam Fibreoptic monitoring at the overflow system

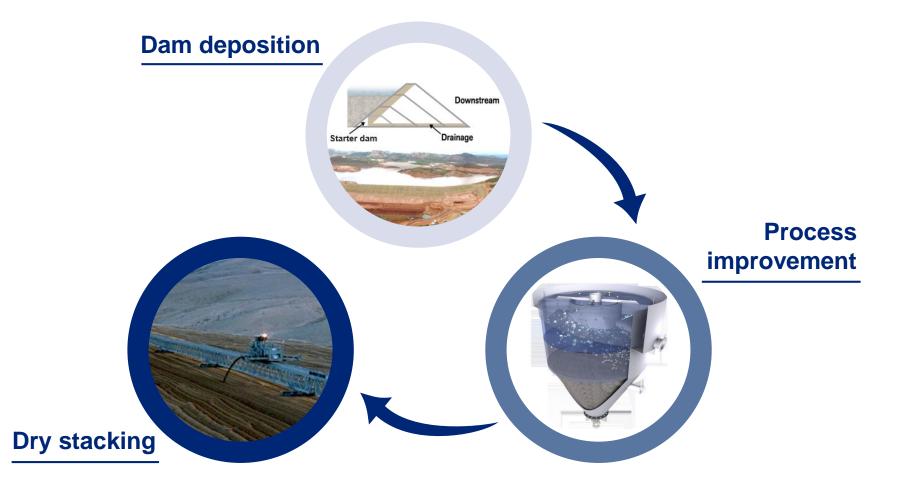
#### Industry leading safety management



6 levels of assurance: 2 internal, 2 external, 2 independent



## **ALTERNATIVE DEPOSITION TECHNOLOGIES: OUR PATHWAY**





## SETTING THE STANDARD IN PIPELINE MANAGEMENT

#### **Fibreoptic monitoring**

Technology selected

ptaSense<sup>®</sup> a QinetiQ company

Implementation by March 2020

#### **PIG runs**

Internal scan of pipeline integrity

Every 2 years, ~2Mt impact (1 month production)

#### Less frequent water batches

Previously pumping was focused on slurry quality, now also focused on pumping pressure

Consistent pressure important for integrity

#### Other pipeline management

Pressure cycles to estimate fatigue

Water pH control optimisation

Monitoring & assessment of corrosion

New reagents to sequester oxygen

Interconnected operation without surge tank

Mapping slopes, tunnels & containment structures

Revised pump design to improve availability & reliability

External coating & cathodic protection inspection



## **P101 DRIVING HIGH PERFORMANCE**

#### Ore feed rate



#### Capacity increase

Ultrafine re-addition into the process to improve slurry specifications

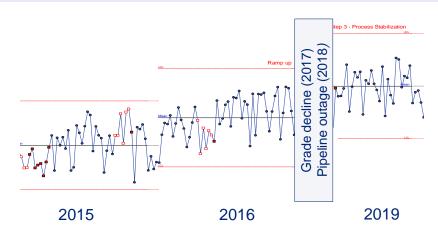
Vertmills optimisation

Access to higher grade ore



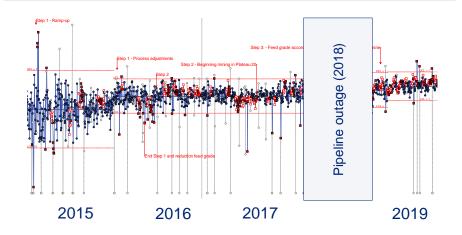
Production increaseNew reagentsStable feedOptimised flotation setupBetter quality ore feed

#### Ore feed rate (dmt/h)



#### Mass Recovery (% of recovery curve)

Improvement in beneficiation





## LONG LIFE, HIGH QUALITY ASSET





Expansion potential Current LOM



# NICKEL



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## **NICKEL KEY MESSAGES**

## **Product quality**

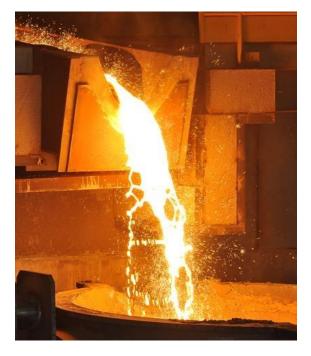
Premium quality ferronickel

## **Operational excellence**

World class stability

## **Markets**

Consistently outperform the market price







## **OPERATIONS OVERVIEW**

## Mining



#### **Barro Alto**

36ktpa average nickel production Large-scale, low-cost and attractive grades

#### Codemin

Integrated with Barro Alto 9ktpa average nickel production

#### Processing



#### **Barro Alto**

World class ferronickel producer

- 2 lines of rotary kiln and electric furnace
- 2 lines of ladle furnace refinery



## FERRONICKEL DEMAND

Nickel		
Class 1 (LME grade)	Class 2	~95%
Applications include stainless & speciality steel,	Ferronickel & nickel pig iron	Nickel resista
electronics, EV batteries, plating & coating, castings	Mainly used for stainless & specialty steel	Attract
plating & coating, castings	specialty steel	Allac

~95%

Ferronickel demand

#### **Ferronickel is Class 2**

~95% of supply used in the manufacture of stainless steel

Nickel enhances properties of stainless steel: corrosion resistance, weldability, formability & ductility

Attractive to stainless steel producers as alloy with pure iron

#### **Stainless steel demand for nickel**

#### World class ferronickel producer

Low carbon

Low phosphorus

Low sulphur

Highest quality product

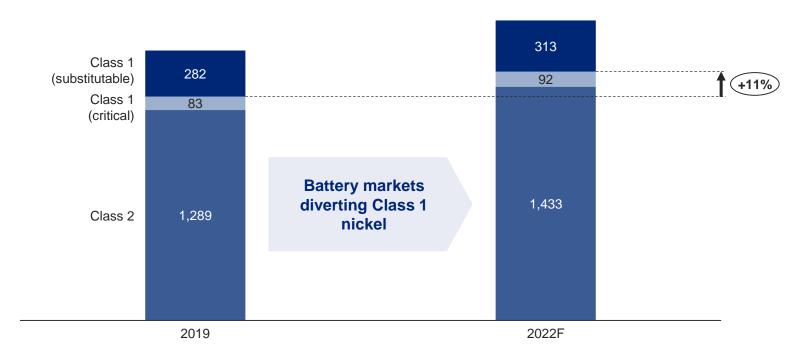


AngloAmerican

~70%

**Global nickel demand** 

## **ELECTRIFICATION & CONSUMER DEMAND SUPPORT NICKEL GROWTH**

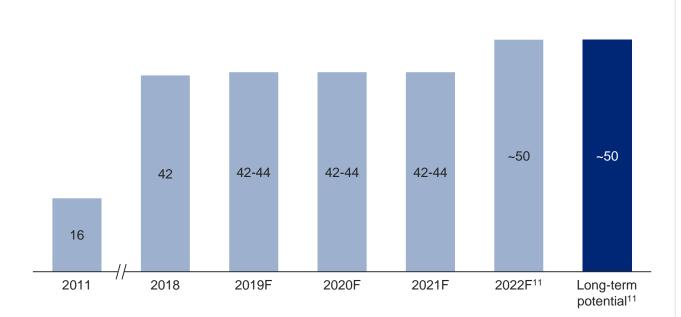






## **ROBUST PERFORMANCE TO CONTINUE**

**Production**<sup>9</sup> (kt)



Including Class 1 nickel from Platinum Group Metals ~70 ktpa

Anglo American is world's 5<sup>th</sup> largest nickel producer

## **Operational stability<sup>10</sup>**

Kilns throughput improvement



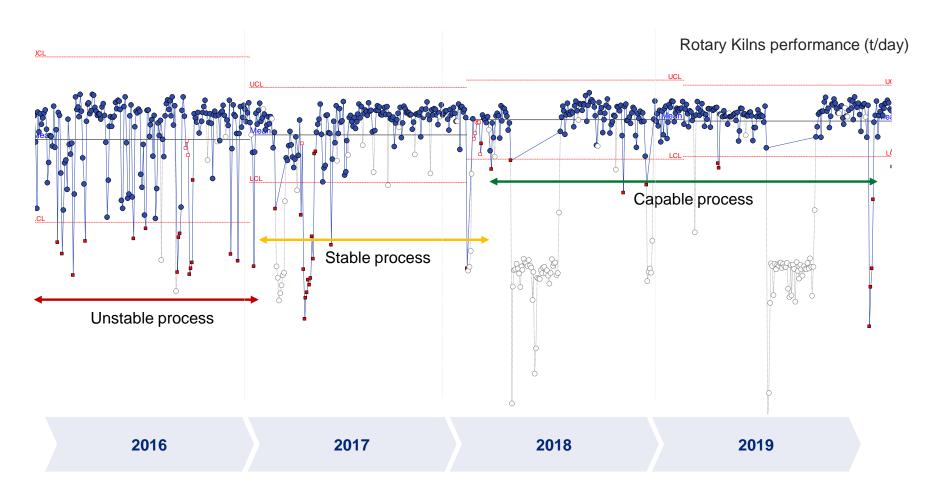
#### **Oil consumption improvement**



Furnace energy consumption improvement



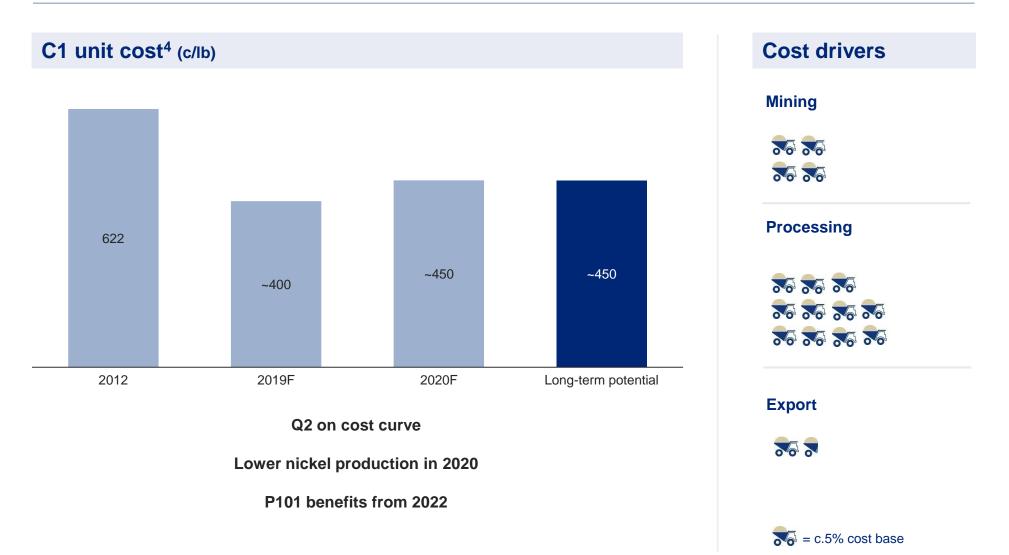
## **OPERATING MODEL IN ACTION**



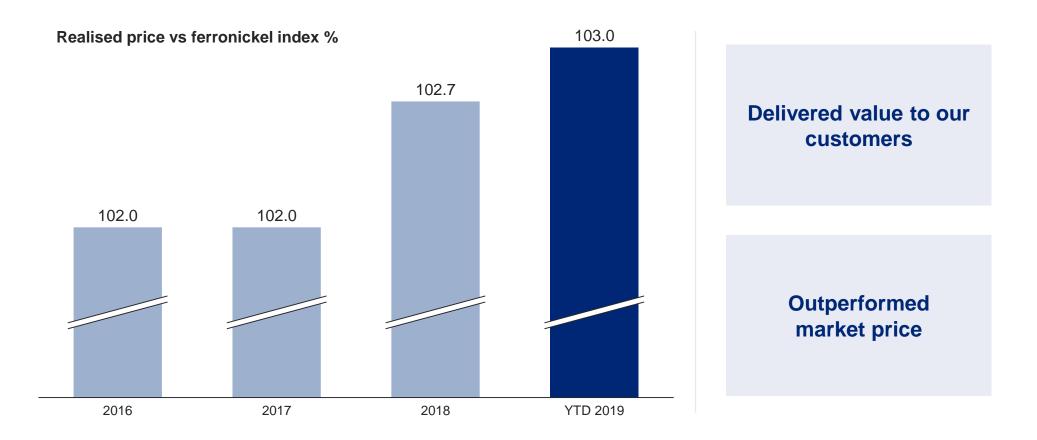
Relentless performance and safety improvement, together with technology deployment programs



## **OPTIMISING COSTS FROM A STABLE BASE**



## **PREMIUM QUALITY PRODUCT**





## **INNOVATION DRIVING PRODUCTION GROWTH**

#### **Bulk ore sorting**

Trial to commence end 2019

Up to 30% grade improvement

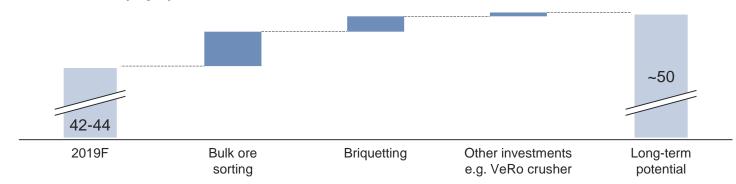
~5ktpa increase in production

#### Briquetting

Increase in safety by reducing gas build-up

~3ktpa increase in nameplate capacity

~5% lower plant electricity consumption







# **A SUSTAINABLE BUSINESS**



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## **FUTURESMART MINING™: SUSTAINABLE MINING PLAN**

Sustainability approach integral to FutureSmart Mining™





## **QUALITY PRODUCTS SUITED TO MODERN MARKETS**

Assets	Capabilities	Returns
Products suited to modern demand	Operating Model	Steady cash generation
Successfully ramped up	FutureSmart Mining™	Modest capital requirement
Established mining jurisdiction	Integrated Marketing function	Robust margins



## FOOTNOTES

- 1. Total Recordable Cases Frequency Rate per million hours.
- 2. Please refer to the AA plc Ore Reserves and Mineral Resources Report 2018 for the tonnes, grades and a breakdown of the classification categories.
- 3. Average during the next 20 years.
- 4. Wet basis. Current guidance assumes receipt of final tailings licence by end 2019. Minas-Rio operations were suspended for the majority of 2018 following two leaks in iron ore pipeline.
- 5. Unit costs exclude royalties, depreciation and include direct support only. Minas-Rio operations were suspended for the majority of 2018 following two leaks in iron ore pipeline.
- 6. Indicative at steady state.
- 7. Saleable product, next 10 years average.
- 8. LOM period at H1 2019 prices.
- 9. Nickel business unit only.
- 10. 2019 performance versus 2017.
- 11. ~50kt dependent on delivery of bulk ore sorting technology.

