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# Analyst & Investor Tour 2014

Itabira, August 6<sup>th</sup> 2014



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# Investor Tour – Strategic Overview

José Carlos Martins

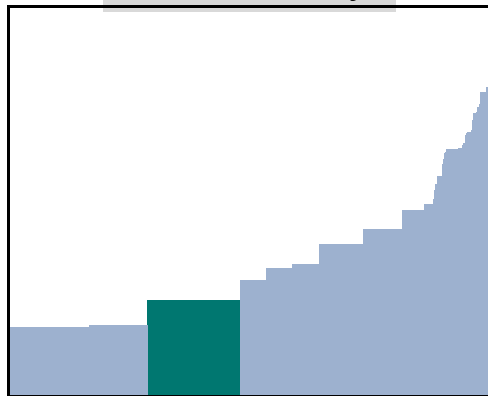
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# VALE'S STRATEGY IN IRON ORE

## Extended Enterprise

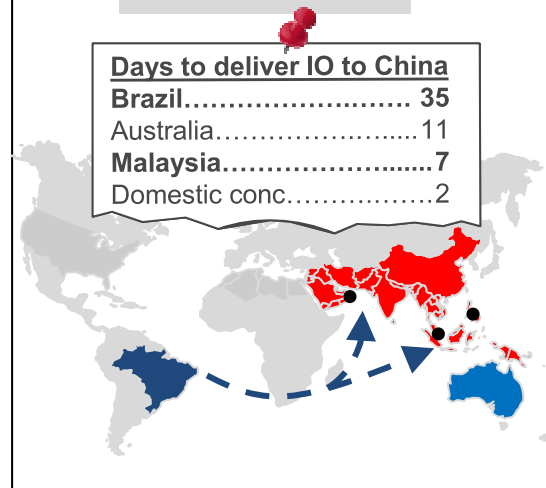
### Production

#### Cost & Quality



### Distribution

#### Time to Market



### Commercialization

#### Tailor to Market

Types of products	Types of delivery	Lot sizes	Sales ontracts
IOCJ	CFR	Valemax	Lagged
Itabirite	FOB BR	Cape	VDP
Blend	FOB CD	1 lot/ship	Current

#### Example of initiatives

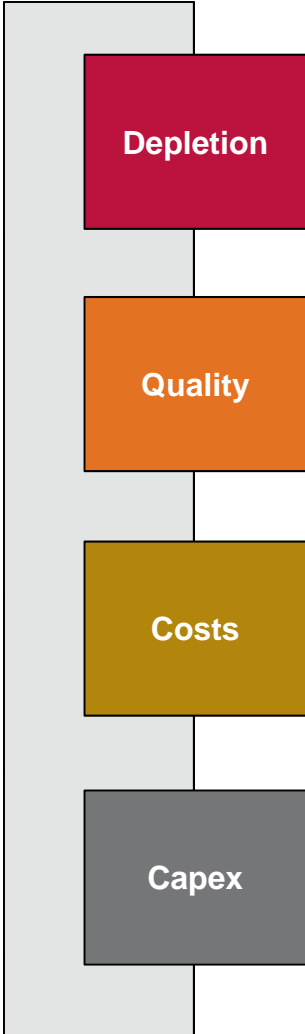
- Itabiritos projects
- Pico Fábrica
- S11D
- Serra Leste

- Malaysia DC
- Valemax berth adaptation
- FTS
- DC's China

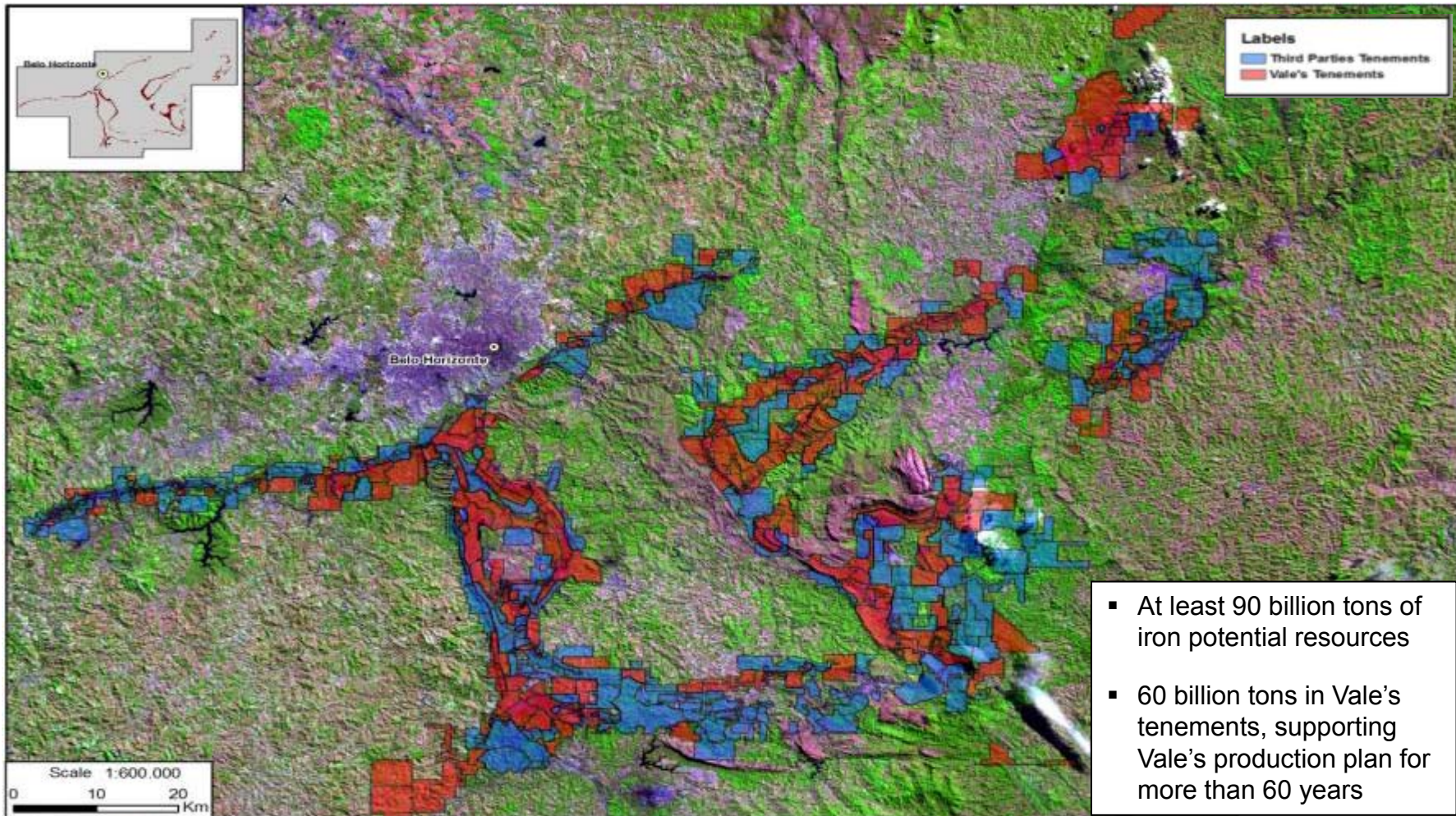
- Green ore
- Single product (TUB)
- Blended products



# COMMON MISUNDERSTANDINGS ON THE ITABIRITOS PROJECT

	<u>Common misunderstandings</u>	<u>Facts</u>
 <p><b>Depletion</b></p>	<ul style="list-style-type: none"> <li>Vale's depletion in the Southern and Southeastern systems is severe</li> </ul>	<ul style="list-style-type: none"> <li>Vale's resources in the Southern and Southeastern systems are of over 60Bt and can be processed for many decades once the selected plants are upgraded</li> </ul>
<p><b>Quality</b></p>	<ul style="list-style-type: none"> <li>Products from the Southern and Southeastern systems are of lower quality</li> </ul>	<ul style="list-style-type: none"> <li>Products from the new Itabirites plants will be best in class for both the Southern and Southeastern systems with Fe higher than 65% and low contaminants</li> </ul>
<p><b>Costs</b></p>	<ul style="list-style-type: none"> <li>Production out of the new Itabirites plants will be higher costs due to the additional processing</li> </ul>	<ul style="list-style-type: none"> <li>Costs will not increase since additional beneficiation will be off-set by lower mining costs a result of lower strip ratios, reduced transportations distances and beneficiation of ore previously treated as waste</li> <li>Quality premiums will cover any additional costs</li> </ul>
<p><b>Capex</b></p>	<ul style="list-style-type: none"> <li>Vale's capital intensity will be very high with the Itabiritos project</li> </ul>	<ul style="list-style-type: none"> <li>Investments in the Itabirites projects are "one-off events" per processing plant on as needed basis</li> <li>Capex for the complete and ongoing Itabiritos projects range from US\$60-100/t, being on the lower limit for the brownfield ones</li> </ul>

## VALE'S IRON ORE RESOURCES IN THE IRON ORE QUADRANGLE



## VALE'S CURRENT SALES MIX AND EVOLUTION OF QUALITY

### Current Situation

- Vale sells lower margin products (e.g. ROM, high silica etc.), leveraging its existing logistics infrastructure
- The Itabirito projects will contribute to reduce the sales of these lower margin products and improve product quality

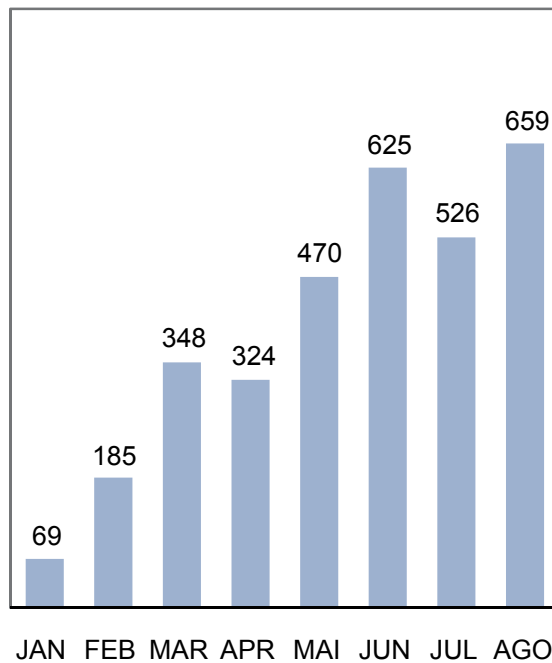
### Evolution of product quality

	2014	2018
Production <sup>1</sup> (Mt)	321	453
Fe	63.9	64.9
SiO <sub>2</sub> + Al <sub>2</sub> O <sub>3</sub>	5.8	4.1
P	0.055	0.050
Share of Production (SiO <sub>2</sub> > 5%)	60%	0%

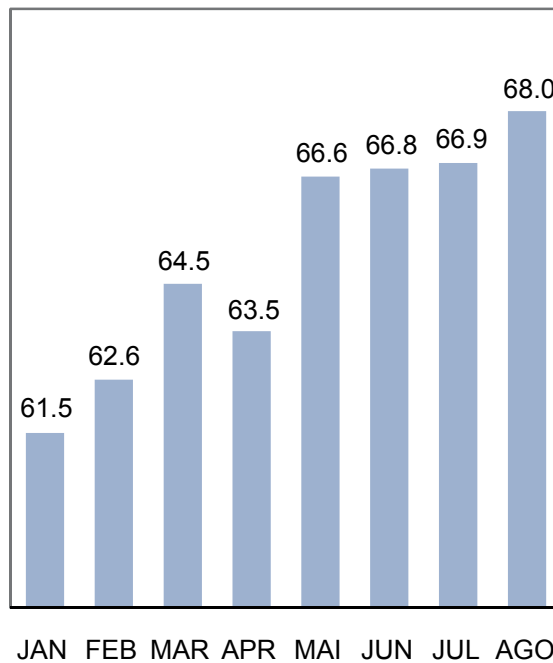
<sup>1</sup> Includes sales of third parties iron ore

# CONCEIÇÃO ITABIRITOS 2014 PERFORMANCE

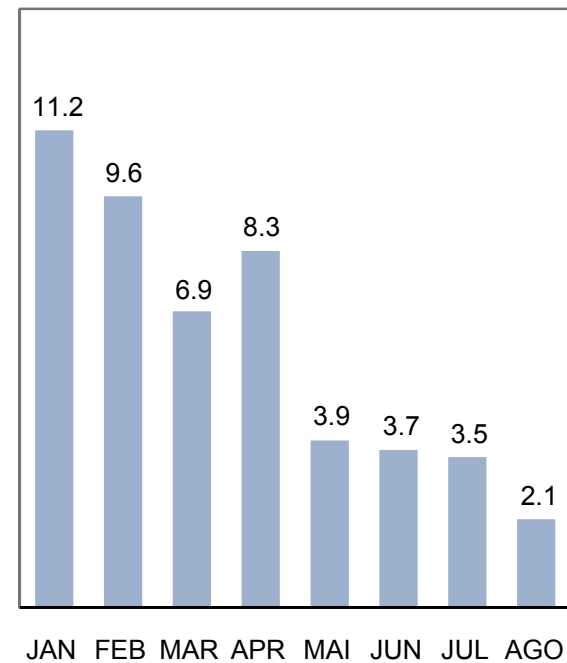
Production (Kt)



Fe content (%)



SiO2 content (%)



## OVERALL BENEFITS OF THE ITABIRITOS PROJECTS



### Costs

- Stable costs as mining costs decrease with lower strip ratios and short transportation distances while processing costs increase marginally due to lower mass recovery and additional beneficiation phases



### Logistics Infrastructure

- Full utilization of the logistic infra-structure already in place



### Resources

- Improved life of mine in the southern and southeastern systems with additional 60 years of production



### Use of sterile piles

- Flexibility to use a range of ores, including ore previously treated as waste



### Productive Capacity

- Production capacity increased such as in:
  - Itabira Complex from 33Mt in 2014 to 55Mt in 2018
  - Vargem Grande Complex from 24Mt in 2014 to 33Mt in 2018



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# Iron ore – From Hematite to Itabirite

Lucio Cavalli

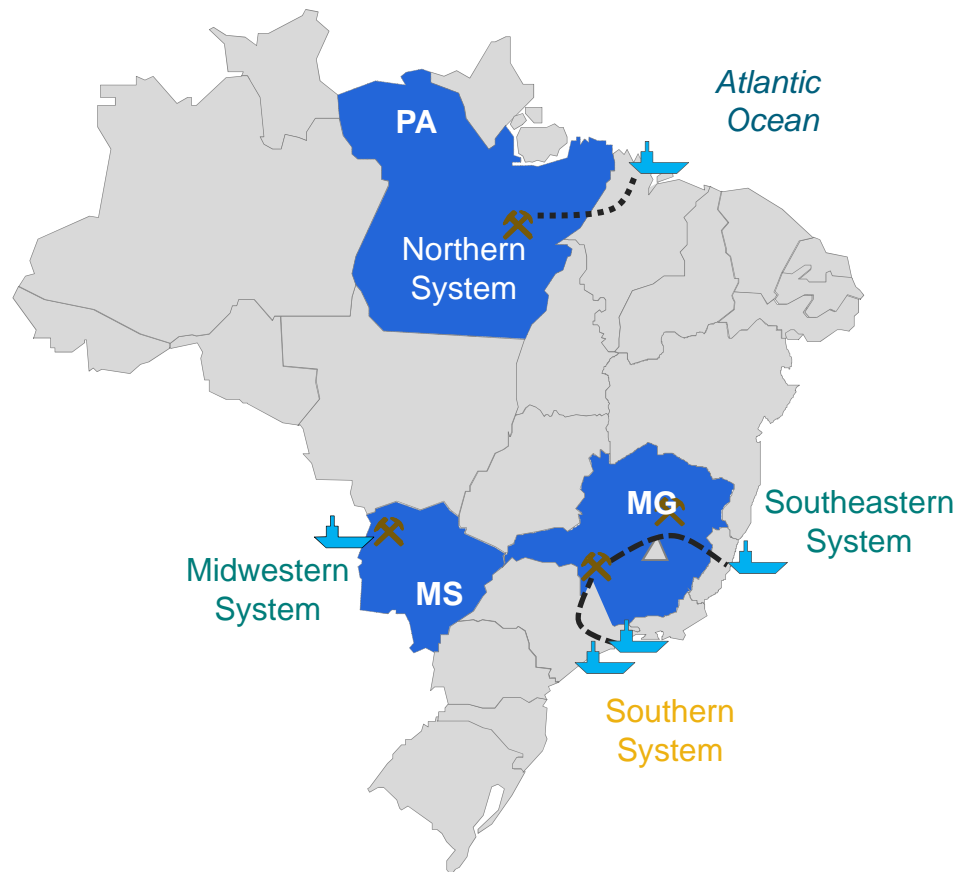
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1. Systems Overview
2. Evolution – From Hematite to Itabirite
3. Production Plan – Example of Itabira
4. Extension of Itabira in the Future

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# Systems Overview

## VALE'S IRON ORE IN KEY FIGURES



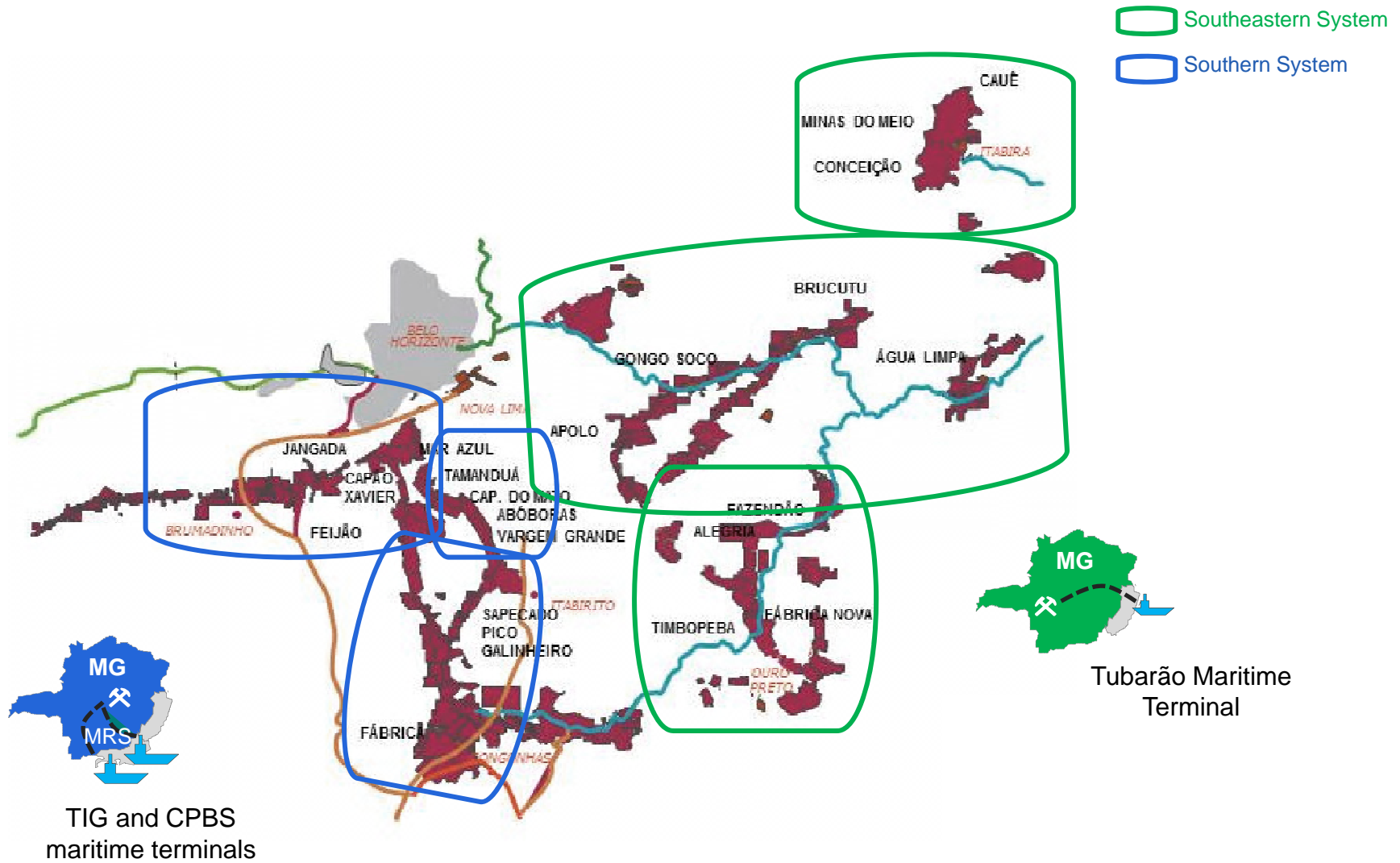
- Four integrated iron ore production systems in Brazil, comprising of mines, railway and port facilities.
  - 22 iron ore mines currently form Vale's production systems<sup>1</sup>
  - Production of 300 Mt<sup>2</sup> in 2013
  - 11 pelletizing plants<sup>3</sup> with production of 39 Mt in 2013
- Southeastern system composed of the EFVM railway and the Tubarao port
- Southern system composed of the MRS railway and both TIG and CPBS ports

<sup>1</sup> Excluding manganese mines

<sup>2</sup> Excluding Samarco

<sup>3</sup> Excluding Samarco, Annyang and Zhuhai

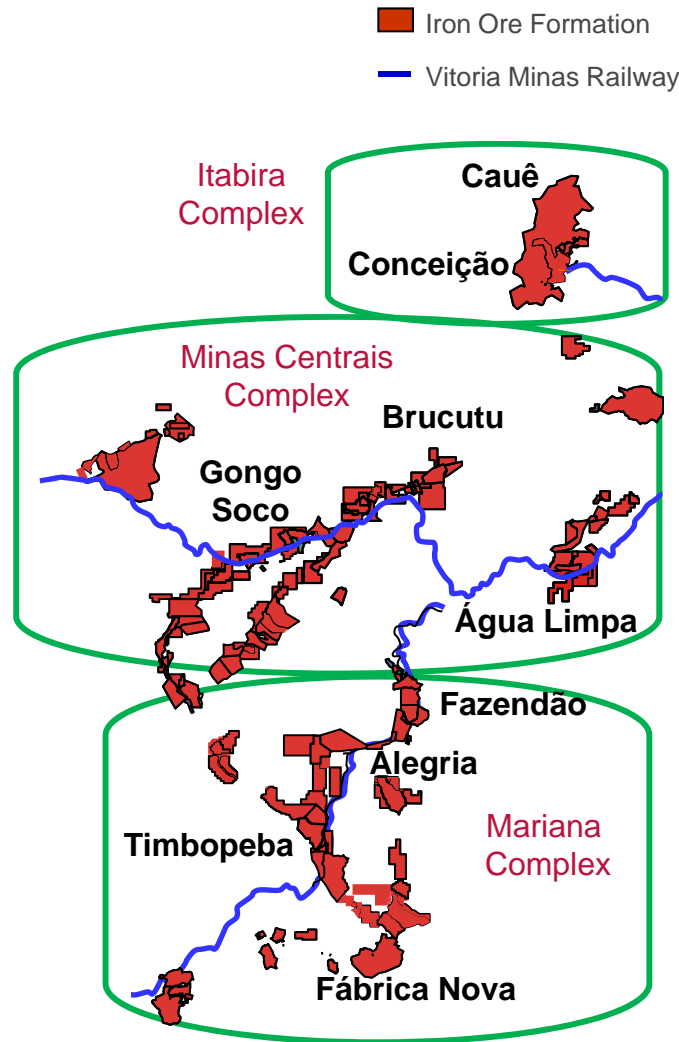
# VALE'S SOUTH SYSTEM AND SOUTHEASTERN SYSTEM





# VALE'S SOUTHEASTERN SYSTEM – RESERVES AND PRODUCTION

## Production complexes

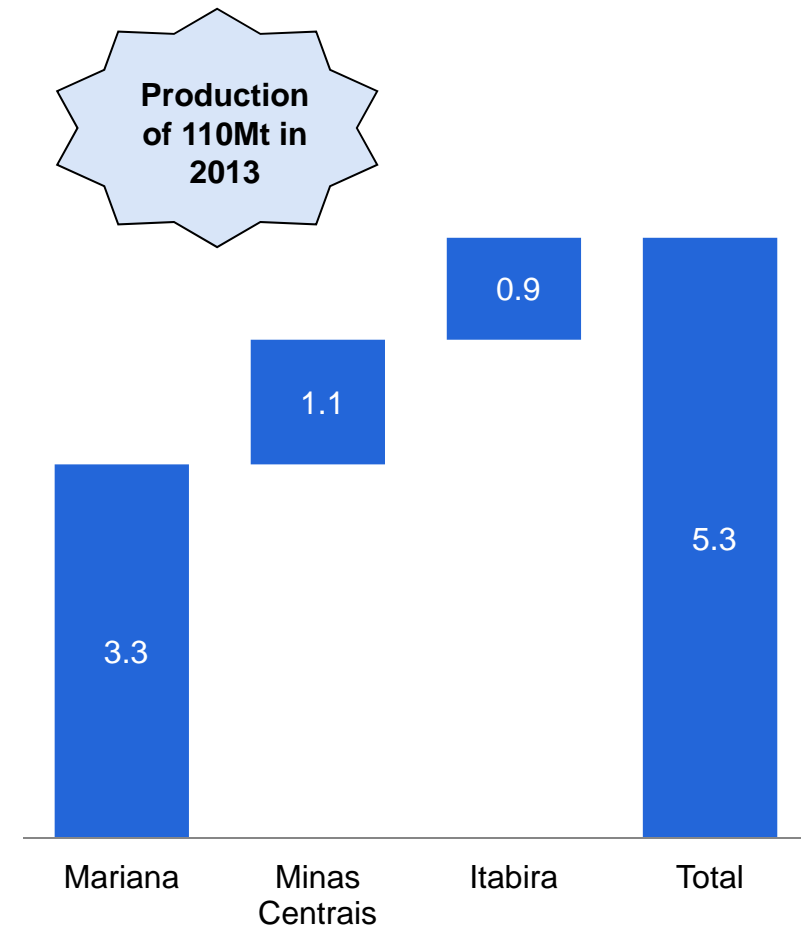


<sup>1</sup> Ex-Samarco

Fonte : 20-F

## Reserves<sup>1</sup>

Bt



# SOUTHEASTERN SYSTEM – EFVM RAILWAY AND TUBARÃO PORT

## Vitória-Minas Railway (EFVM)



- Extension of 905 km<sup>1</sup>
- Transportation of 40% of all railway cargoes in Brazil, carrying 60 products other than iron ore

## Tubarão Port



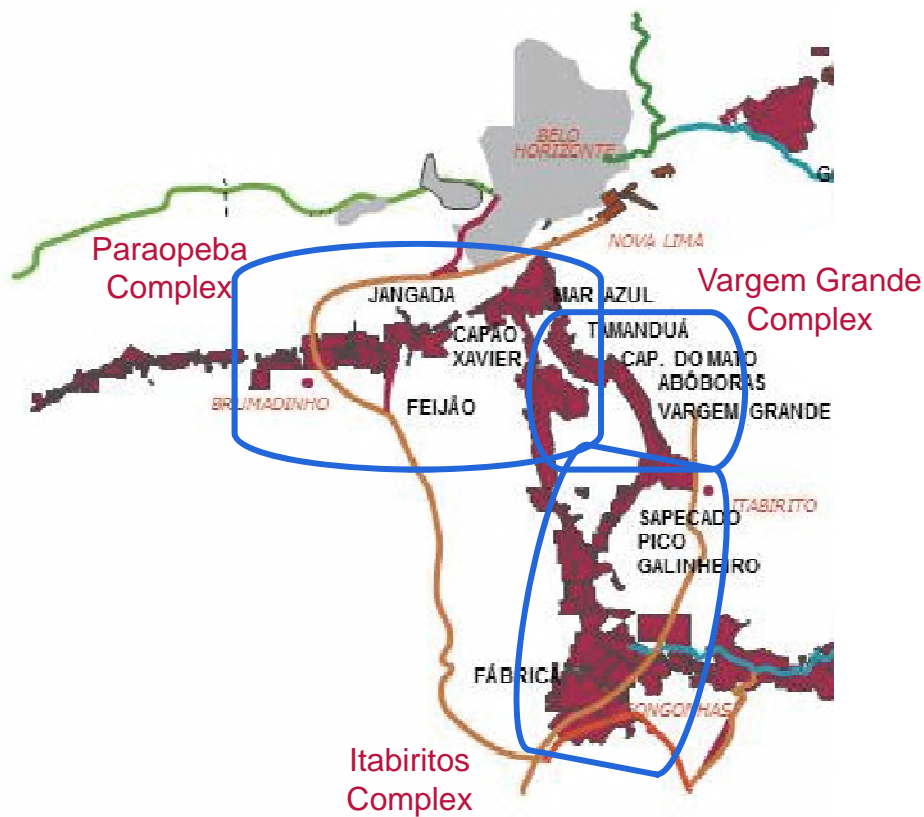
- 18 km<sup>2</sup> with 3 terminals
  - Iron ore
  - Praia Mole (mainly coal)
  - Other products (General cargo)
- Iron Ore terminal with 20 meters draft, stockyard capacity of 3.4 Mt and 2 piers<sup>2</sup>

<sup>1</sup> 601 km of double track and 304 km of single track

<sup>2</sup> Pier I: 2 vessels at a time (170,000 DWT on the southern side and 200,000 DWT on the northern side) and 2 ship loaders; Pier II: one vessel up to 405,000 DWT at a time and 2 ship loaders

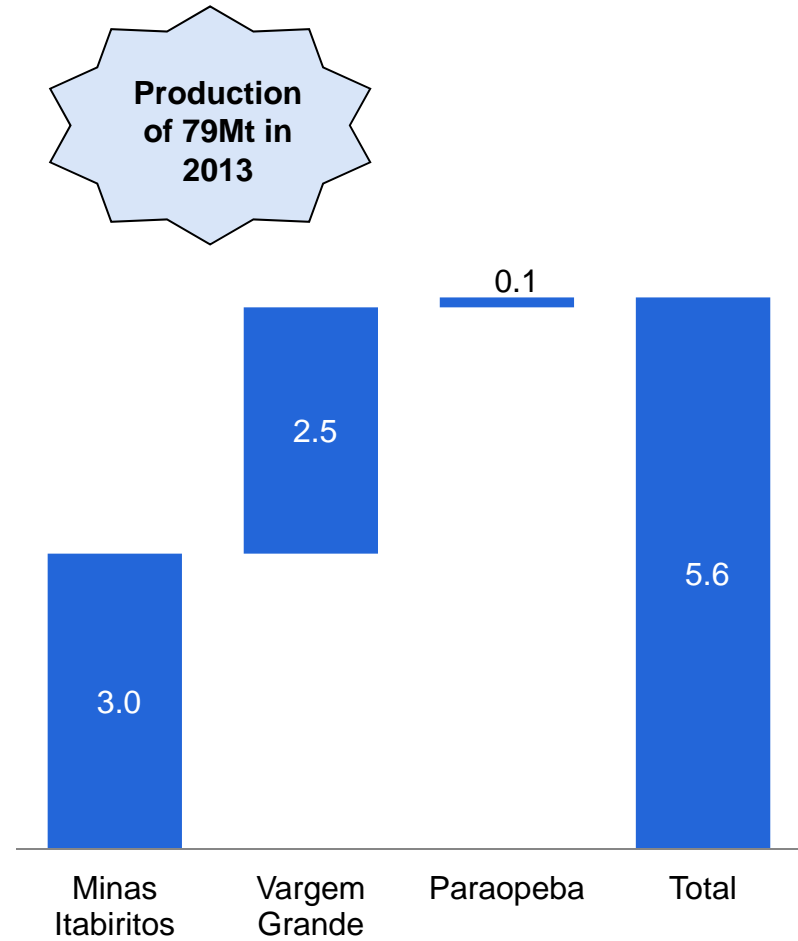
# VALE'S SOUTHERN SYSTEM – RESERVES AND PRODUCTION

## Production complexes



## Reserves

Bt



## SOUTHERN SYSTEM LOGISTIC – MRS AND GUAÍBA/ITAGUAÍ

### MRS Railway



- Extension of 1,643 km
- Controlled by Vale, CSN, Usiminas and Gerdau
  - Vale has a 47.6% controlling stake in MRS

### Itaguaí Maritime Terminal



- Cia Portuária Baía de Sepetiba (CPBS) is a wholly-owned subsidiary that operates the Itaguaí terminal
- Composed of 1 pier with 1 berth
- Capable of receiving vessels of up to 200,000 DWT (18 meters of draft)

### Guaíba Maritime Terminal

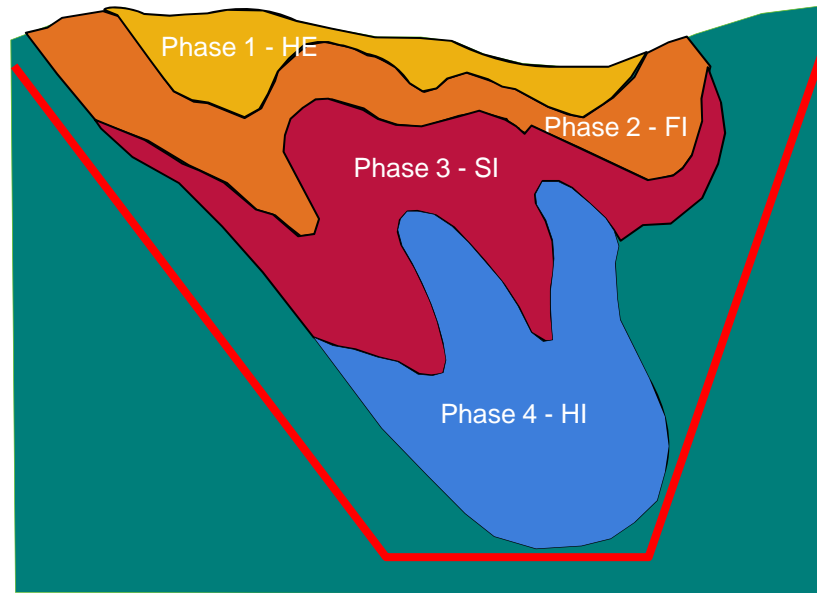


- Composed of 1 pier with 2 berths
- Capable of receiving vessels of up to 350,000 DWT (20 meters of draft)

**Evolution – From  
Hematite to Itabirite**

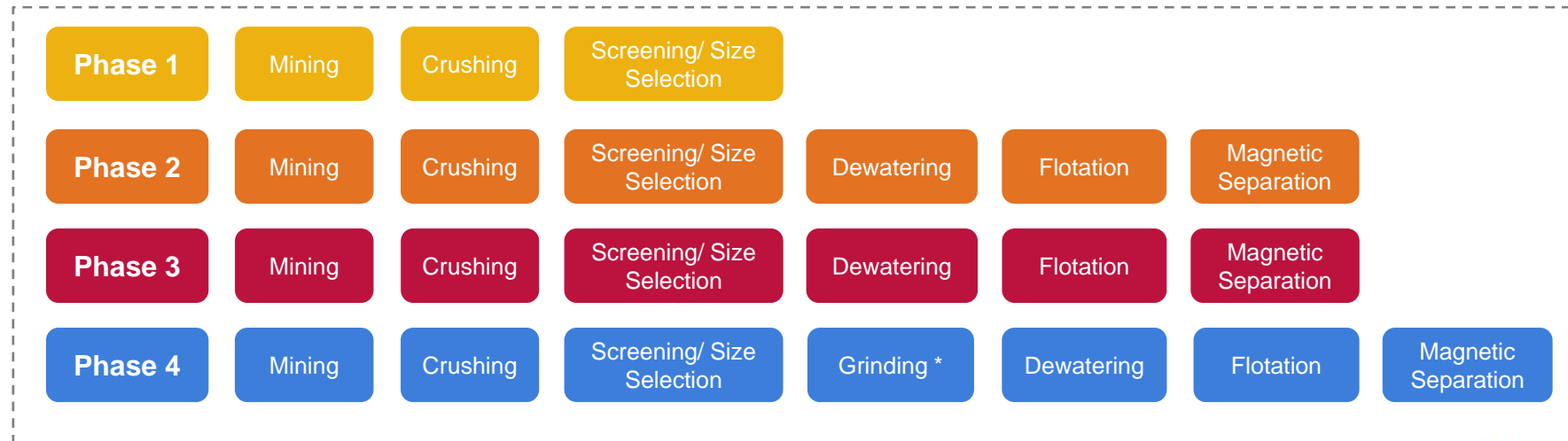


# EXPLOTATION PHASES - FROM HEMATITE TO ITABIRITES



Phase	1	2	3	4
Ore type	Hematite (HE)	Friable Itabirite (FI)	Soft Itabirite (SI)	Hard Itabirite (HI)
Fe grade (%)	> 60 %	50-58%	40-50%	30-40%
Mass recovery (%)	75-100 %	70-75 %	50-60%	40-50 %
Tailings	-	25-30%	40-50%	50-60%
Final product	Lump ore Sinter feed	Sinter feed Pellet feed	Sinter feed Pellet feed	Pellet feed
Time line	1940-1960	1970-2000	2010	2012

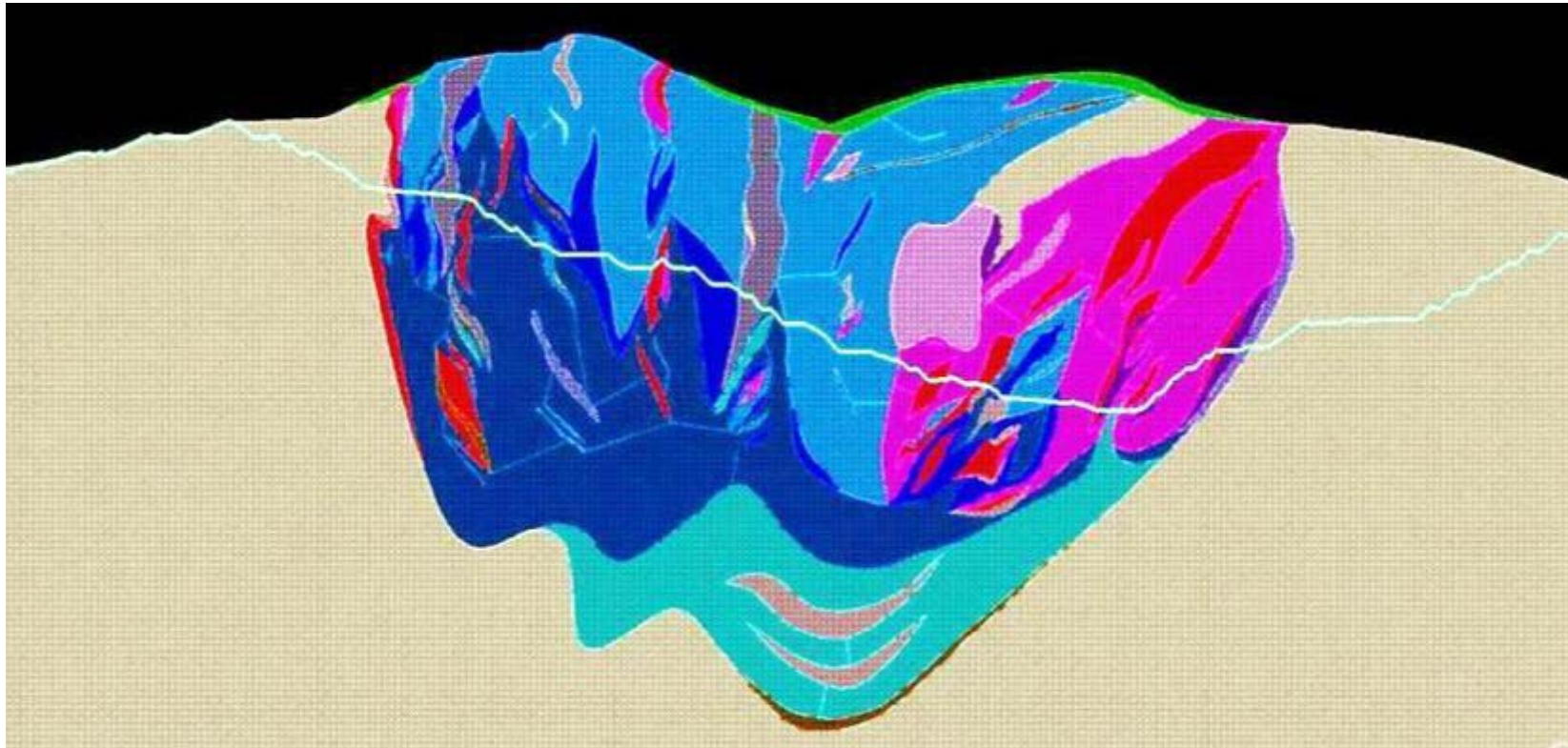
## Phases & Processes



\* New Phase

## CROSS SECTION FROM CONCEIÇÃO FINAL PIT 2008

Example



Hematite



Friable Itabirite



Lower grade / soft  
Itabirite

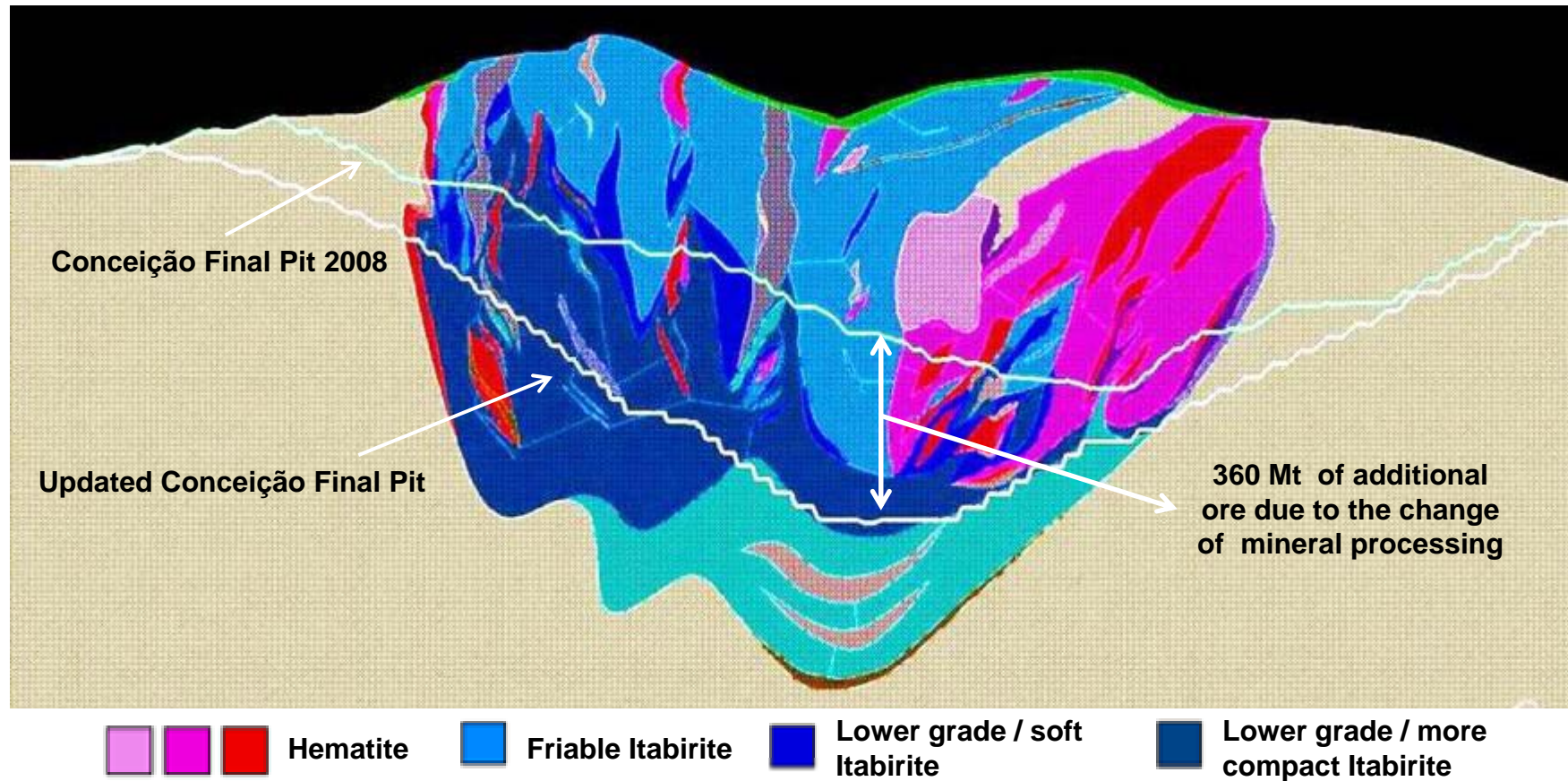


Lower grade / more  
compact Itabirite

Conceição final pit estimated in 2008 did not optimize the mineral ore body due to the lack of processing capacity of more compact and lower grade itabirites

# CROSS SECTION FROM UPDATED CONCEIÇÃO FINAL PIT

Example

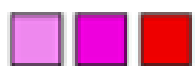
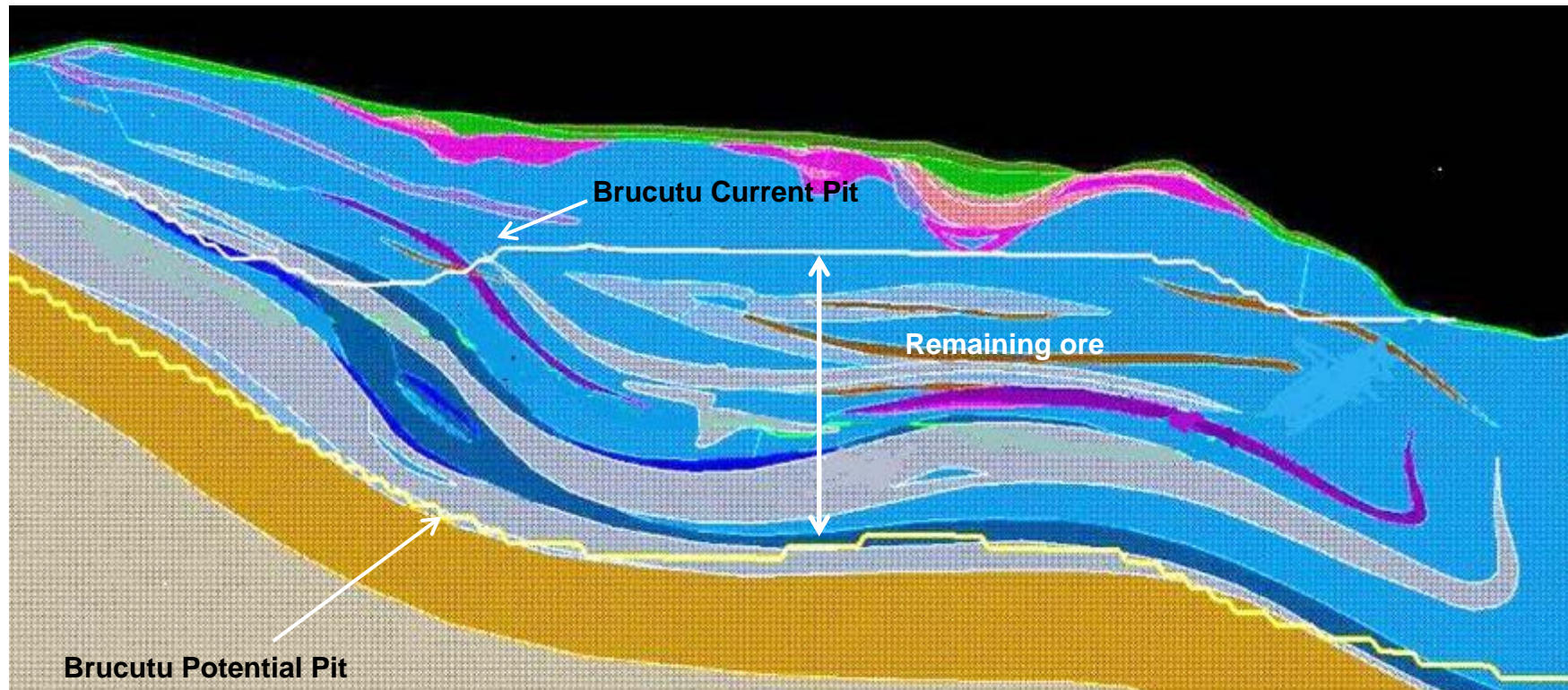


The new Itabiritos plants are able to process ore previously considered waste, increasing the life span of Vale's mineral assets



# CROSS SECTION - BRUCUTU PIT POTENTIAL

Example



Hematite



Friable Itabirite



Lower grade / soft  
Itabirite

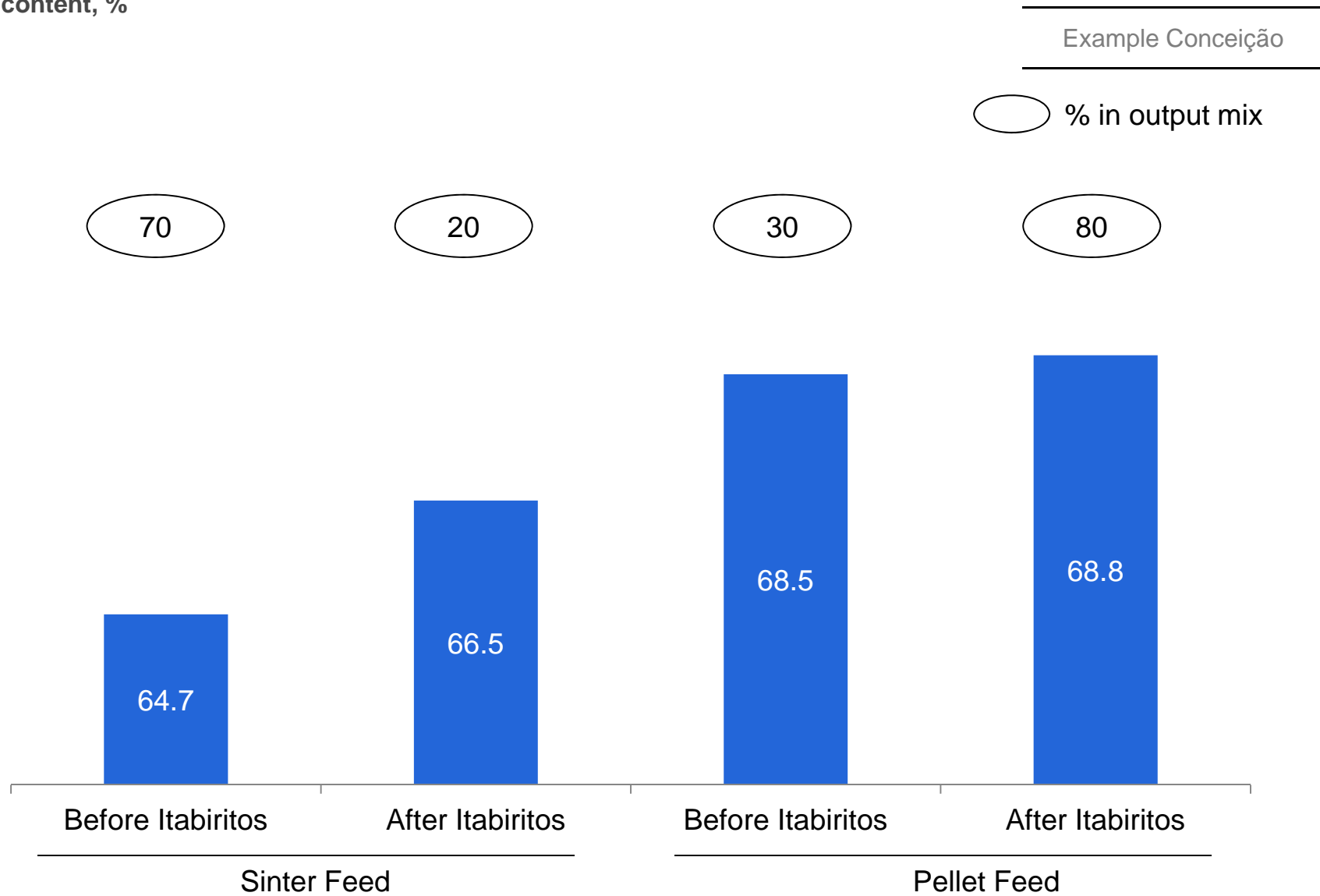


Lower grade / more  
compact Itabirite

Additional volumes can be exploited in all mines with the Itabiritos projects

# PRODUCT QUALITY IMPACT OF THE ITABIRITOS PROJECTS

Fe content, %



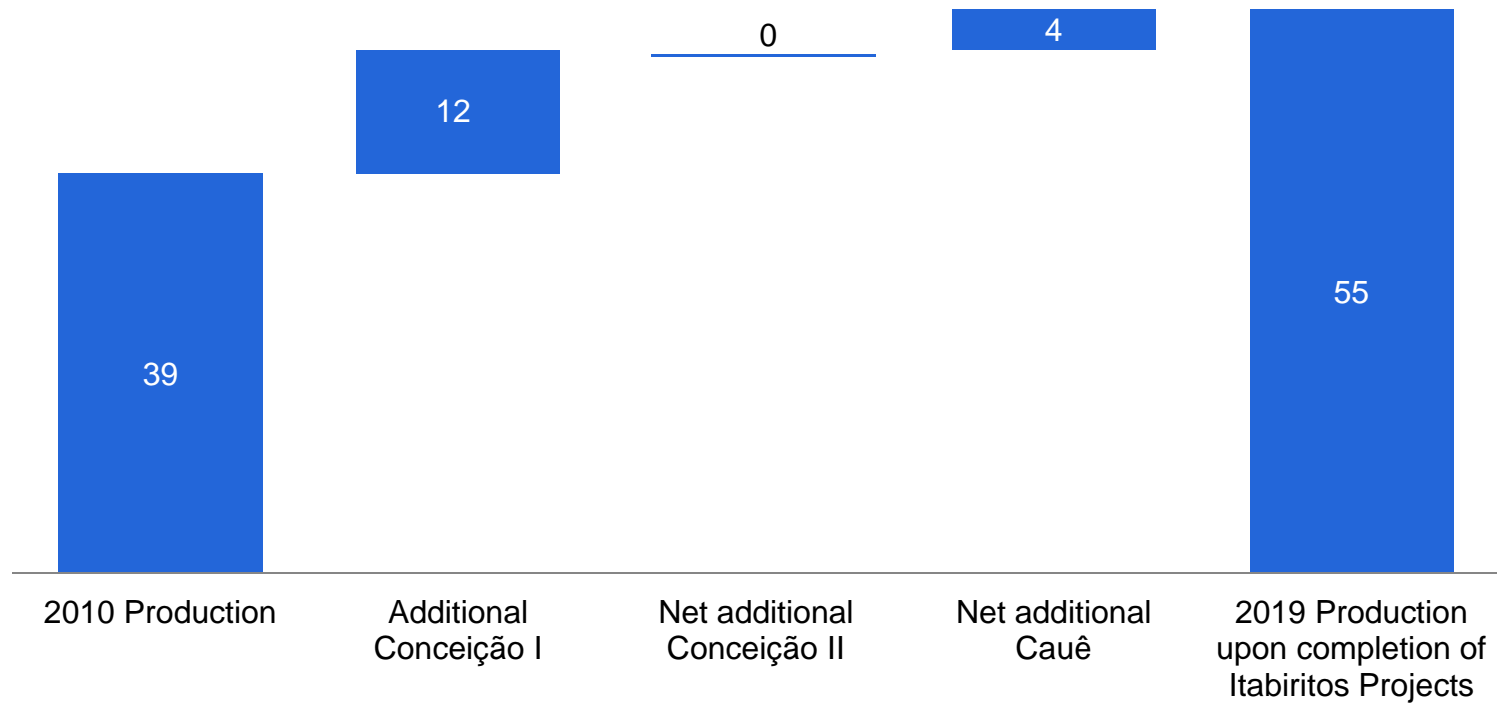


# **Production Plan - Example of Itabira**

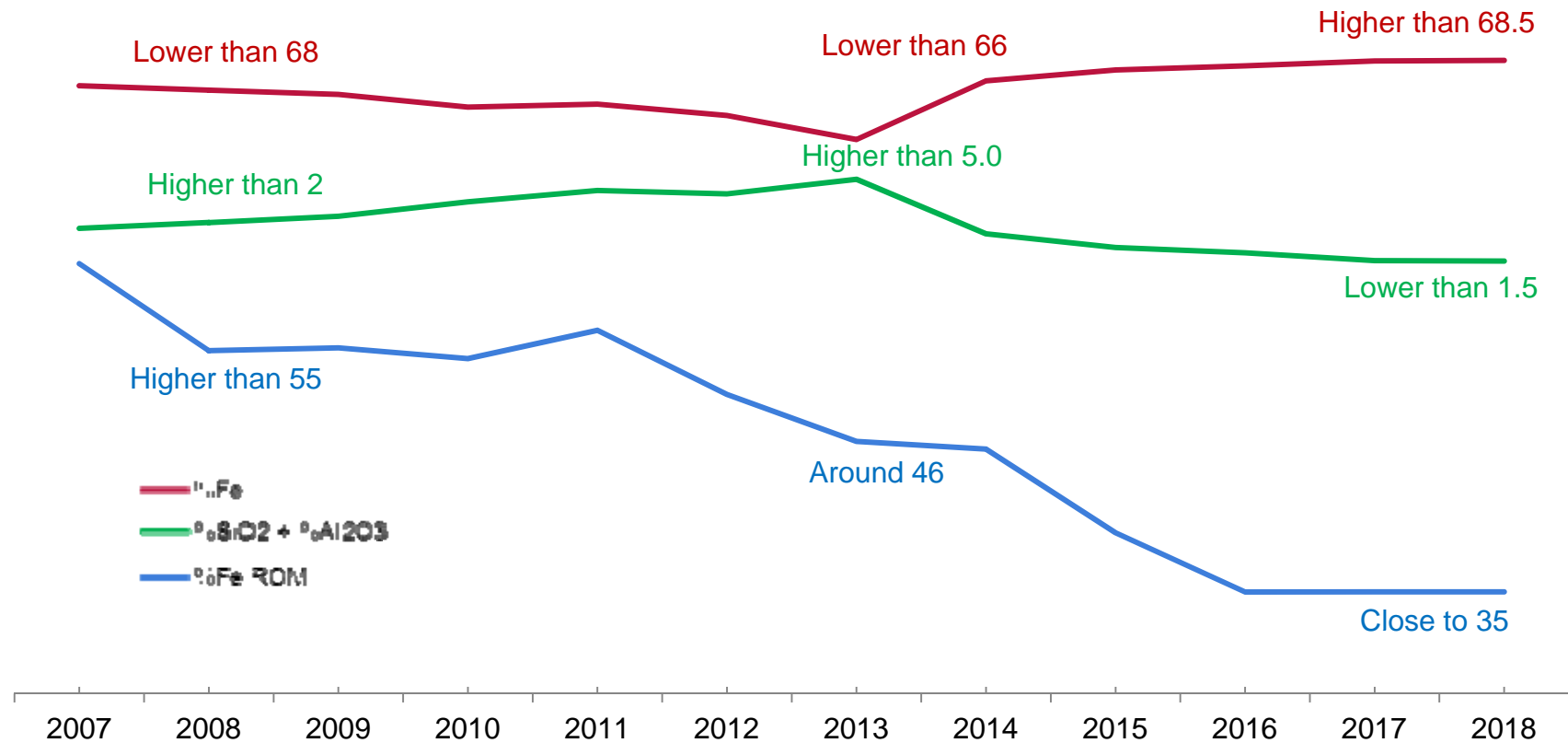
# NET CAPACITY INCREASE WITH THE ITABIRITOS PROJECT

Mt

Example Itabira Complex

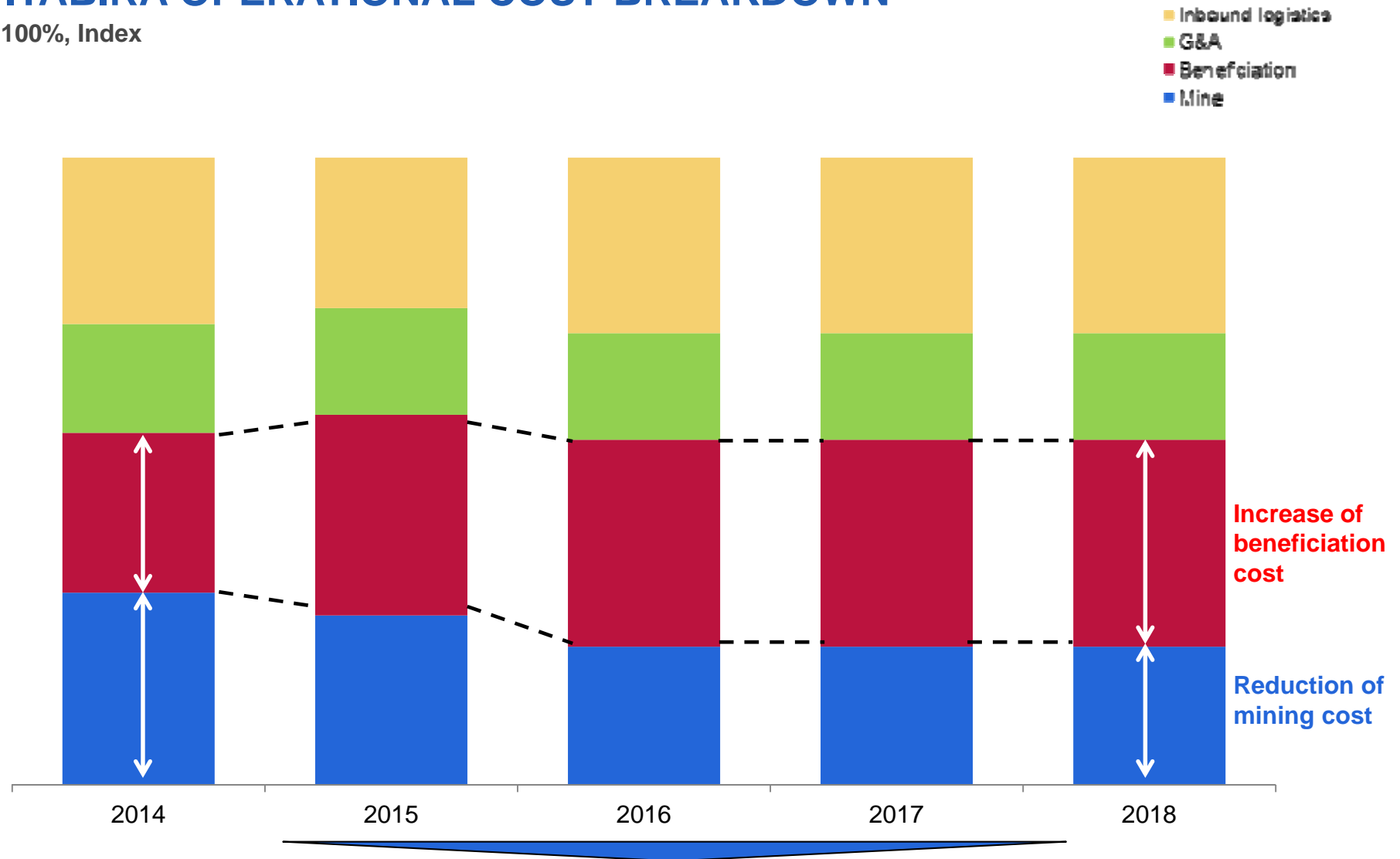


# ITABIRA OPERATIONAL QUALITY EVOLUTION



## ITABIRA OPERATIONAL COST BREAKDOWN

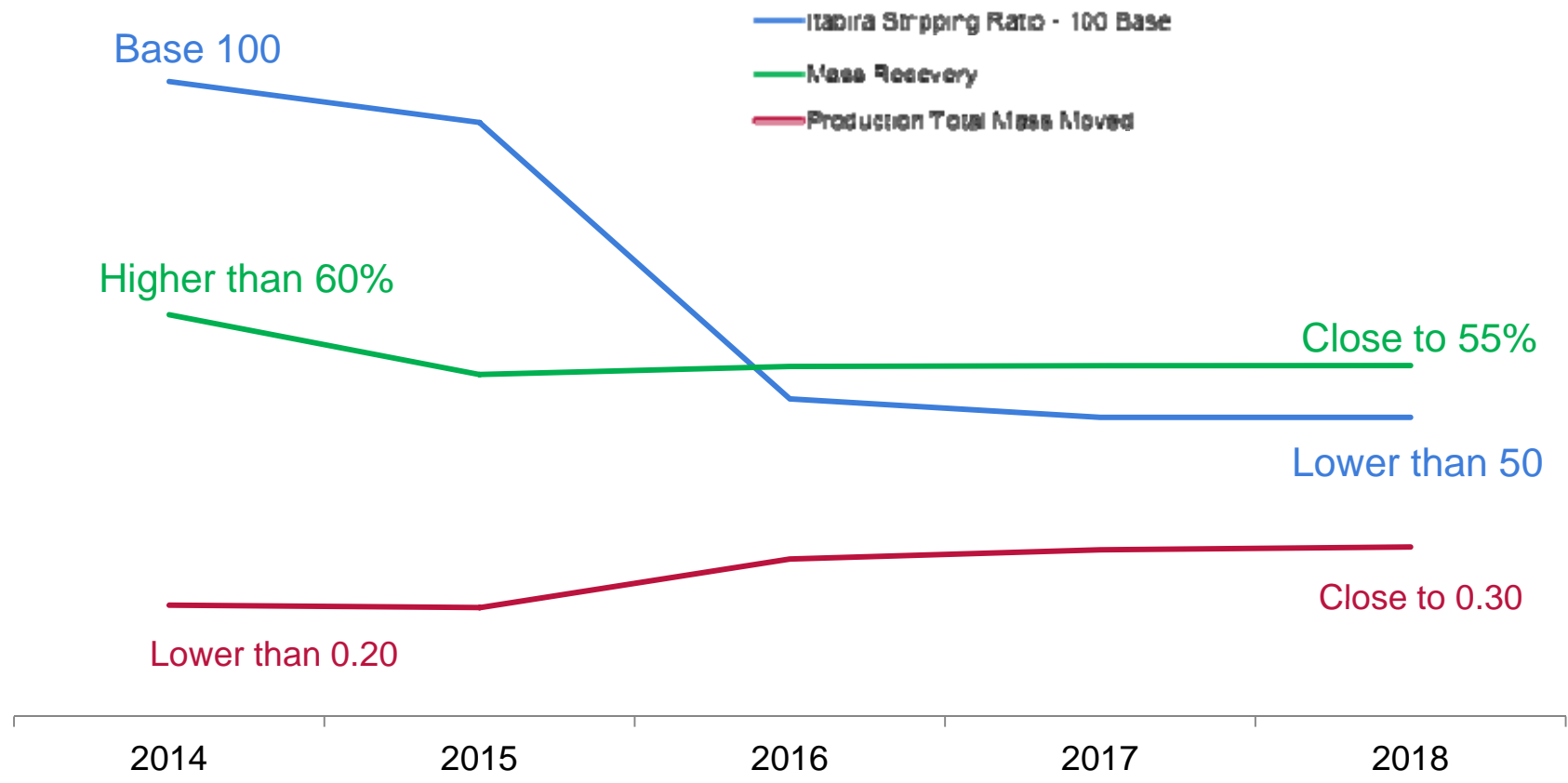
100%, Index



There is no significant impact in the total iron ore costs due to the Itabirito projects

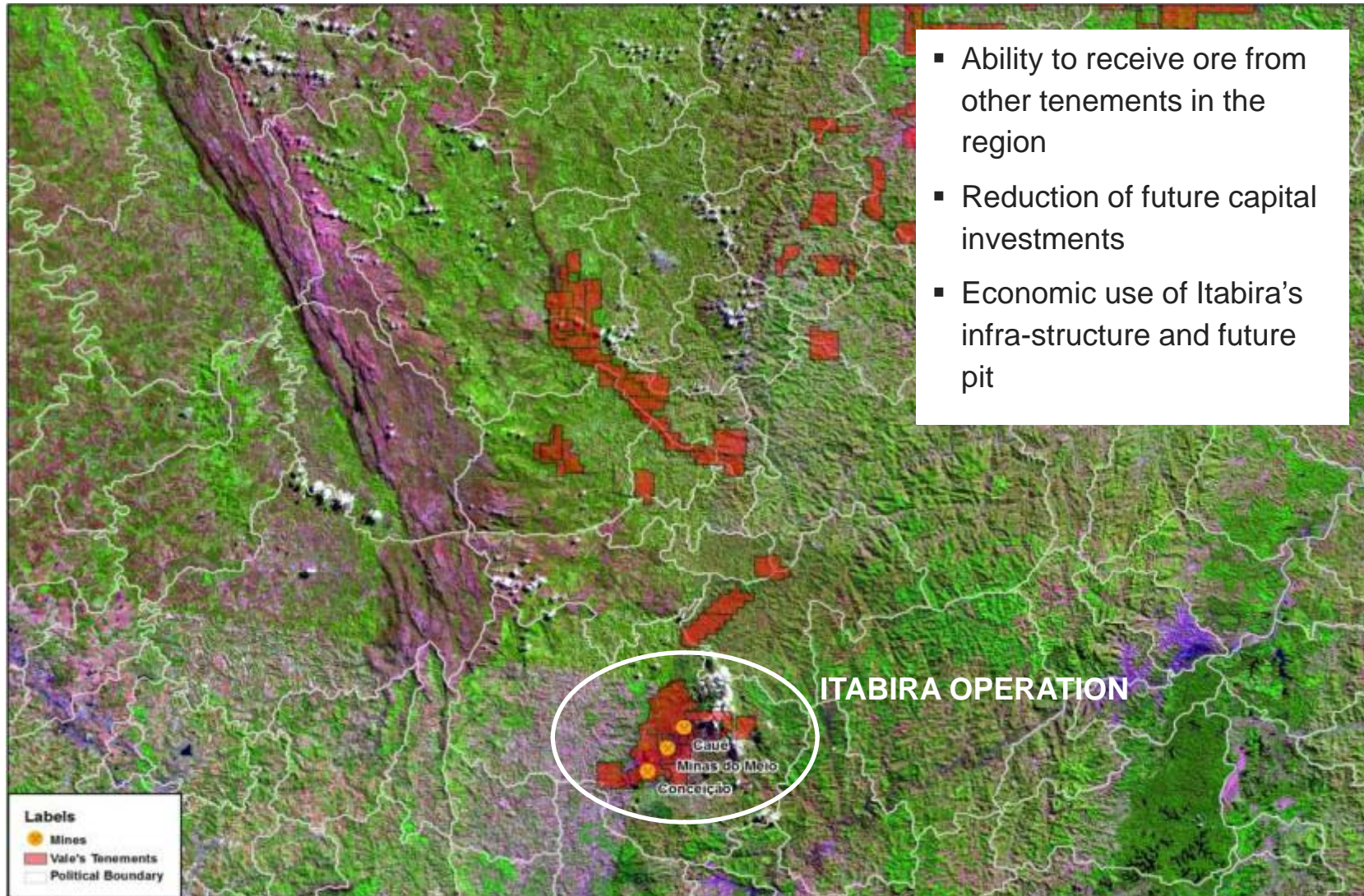
# EVOLUTION OF COST DRIVES - ITABIRA COMPLEX

Non-Exhaustive



# **Extension of Itabira in the Future**

## HUB ITABIRA – A NEW LONG MINING CYCLE IS JUST STARTING...





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# Investor Tour – Itabiritos Projects

Ivan Montenegro

Analyst & Investor  
Tour 2014



# Itabirito Projects

A total investment of US\$ 5.8 billion aiming at increasing the output capacity of the mines in Itabira and Vargem Grande, as well as improving the life cycle of those mines

Our values

# Life matters most



Investing in training and behavior programs that contribute to the awareness of employees



Investing in new methods and technologies focusing on the prevention of risks and accidents

# Life matters most



Support facilities



Volunteer actions



# Improving together



In total, about **34,000 people** have already worked in the projects, **26,000 from Minas Gerais**



**6,050 people** were trained for **first employment** with the partnership of SENAI

# Improving together



About **R\$ 750 million** already contracted from local suppliers



About **R\$ 72 million** already paid in local taxes



# Prize our planet

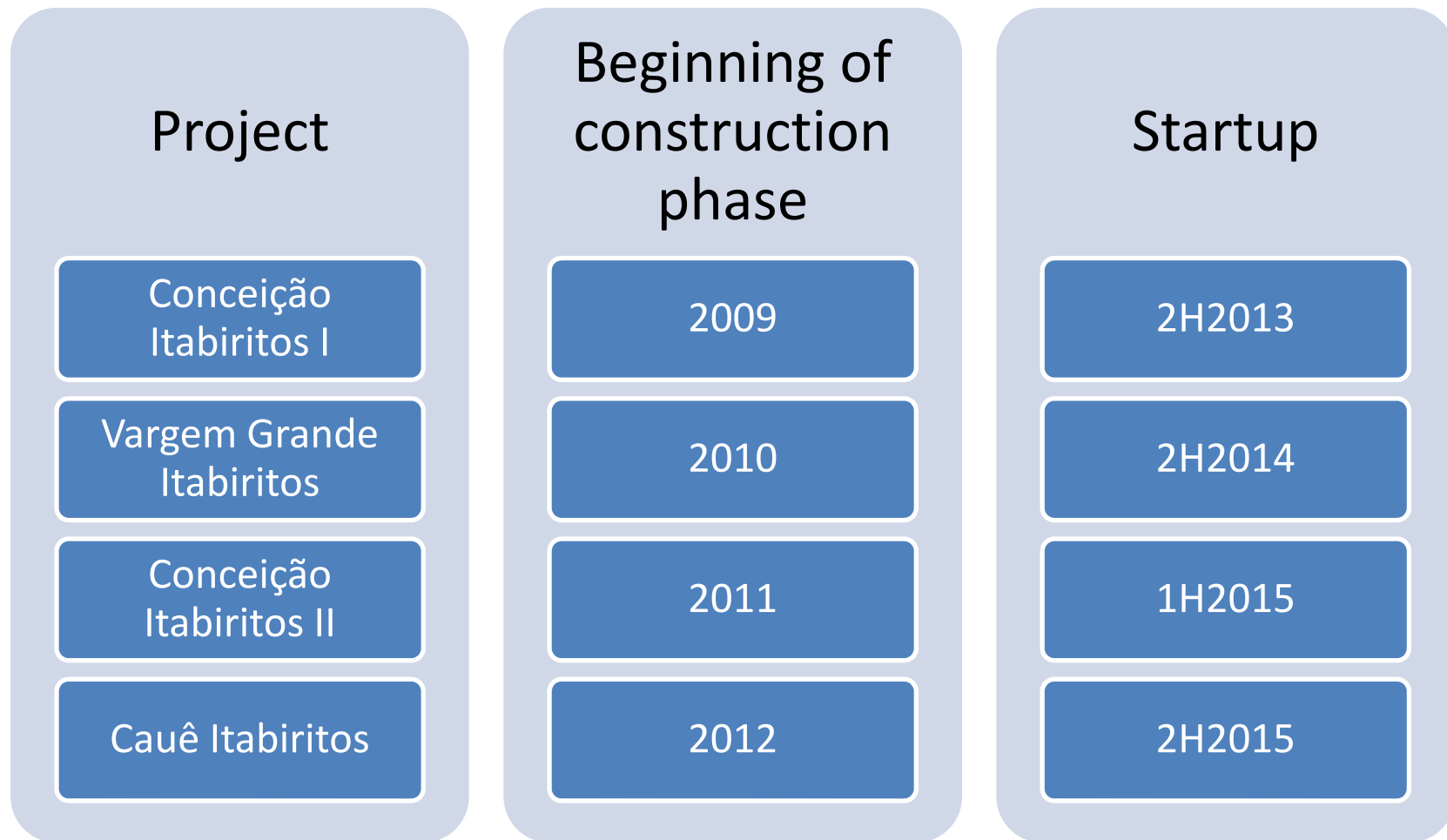


New plants provide for recirculation of approximately **80% of the water** used during the operation



Reuse of waste from construction and demolished structures

# Timeline



# Conceição Itabiritos I

Construction of a new compact itabirite processing plant with low content of iron



- ✓ Capacity : 12 Mtpy
- ✓ Product Quality: 68.8% PF
- ✓ Capex: US\$ 1.173 billion
- ✓ Start-up: 2H/13
- ✓ Physical Progress: 100%
- ✓ Financial Progress: US\$ 1.061 billion

\* Date from June 30/14





**Accumulated  
production up to  
July: 2.5 million tons**

**Product Pile**







General View – Dry Process





**General View – Wet Process**



**Grinding Stockyard**







Grinding







## High Frequency Screening







Product Thickener





Tailings Thickener







Filtering







**Product Stockyard**





# Conceição Itabiritos II

Construction of new facilities and revamp of the existing plant in Conceição for the processing of compact itabirite

- Capacity: 19 Mtpy (13 Mtpy PF / 6 Mtpy SF)
- Product Quality: 68.9% PF and 66.3% SF
- Capex: US\$ 1.188 billion
- Mechanical Completion: 2H/14
- Startup: 1H/15
- Physical Progress: 90%
- Financial Progress: US\$ 780 million



# Conceição Itabiritos II Project Macro Schedule

PROJECT PHASE	Phys. Prog. June/14	2010		2011		2012		2013		2014		2015	
		1H	2H	1H	2H	1H	2H	1H	2H	1H	2H	1H	2H
Project Approval in DCA	-			◇									
Detailed Engineering	100,0%			●	●	●	●	●	●	●			
Procurement	97,1%		●	●	●	●	●	●	●	●	●	●	
Construction	70,2%				●	●	●	●	●	●	●	●	
Commissioning	0,9%							●	●	●	●	●	●
Start-up	-												◇



**Project Plant 3D  
Conceição Itabiritos II**





**General View – Conceição Itabiritos II**







## Grinding





Product Thickener







Tailings Thickener





## Flotation





Screening





# Cauê Itabiritos

Construction of new facilities and revamp of the existing plant in Cauê for the processing of compact Itabirite



- Capacity: 24 Mtpy (17 Mtpy PF and 7 Mtpy SF)
- Product Quality: 68.6% PF and 65.3% SF
- Capex: US\$ 1.504 billion
- Startup: 2H/15
- Physical Progress: 63%
- Financial Progress: US\$ 494 million

\* Date from June 30/14

# Cauê Itabiritos Project Macro Schedule

PROJECT PHASE	Phys. Prog. June/14	2011		2012		2013		2014		2015		2016	
		1H	2H	1H	2H	1H	2H	1H	2H	1H	2H	1H	2H
Project Approval in DCA	-			◇									
Detailed Engineering	99,9%		●	●	●	●	●	●					
Procurement	85,7%			●	●	●	●	●	●	●			
Construction	43,2%				●	●	●	●	●	●			
Commissioning	0,0%							●	●	●	●		
Startup	-											◇	





**Project Plant 3D - Cauê Itabiritos**







**Project Plant 3D -  
Cauê Itabiritos**









Crushing







Screening





Grinding







Main Substation





## Flotation





Tailings Thickener



# Vargem Grande Itabiritos

Construction of a processing plant composed by grinding, concentration plant and stockyard, interconnected with the Vargem Grande Pelletizing Plant

- 
- Capacity : 10 Mtpy
  - Product Quality: 68% PF
  - Capex: US\$ 1.621 billion (ITM)
  - Capex US\$ 289 million (TFA)
  - Start-up: 2H/14
  - Physical Progress: 92%
  - Financial Progress: US\$ 1.506 billion

\* Date from June 30/14

# Vargem Grande Itabiritos Project Macro Schedule

PROJECT PHASE	Phys. Prog. June/14	2010		2011		2012		2013		2014		2015	
		1H	2H	1H	2H	1H	2H	1H	2H	1H	2H	1H	2H
Project Approval in DCA	-	◇											
Detailed Engineering	100%	●	●	●	●	●	●	●	●				
Procurement	97,2%	●	●	●	●	●	●	●	●	●			
Construction	90,3%		●	●	●	●	●	●	●	●			
Commissioning	15,2%									●	●		
Startup TCLD											◇		
Startup ITM	-											◇	



## Primary Crushing





**Primary Crushing Product**



Screening







Crushing







Grinding





Filtering







**Long Distance Conveyor**





**Main Substation**





**General View - Vargem Grande Itabiritos**







Product Reclaimer







**Product Pile**

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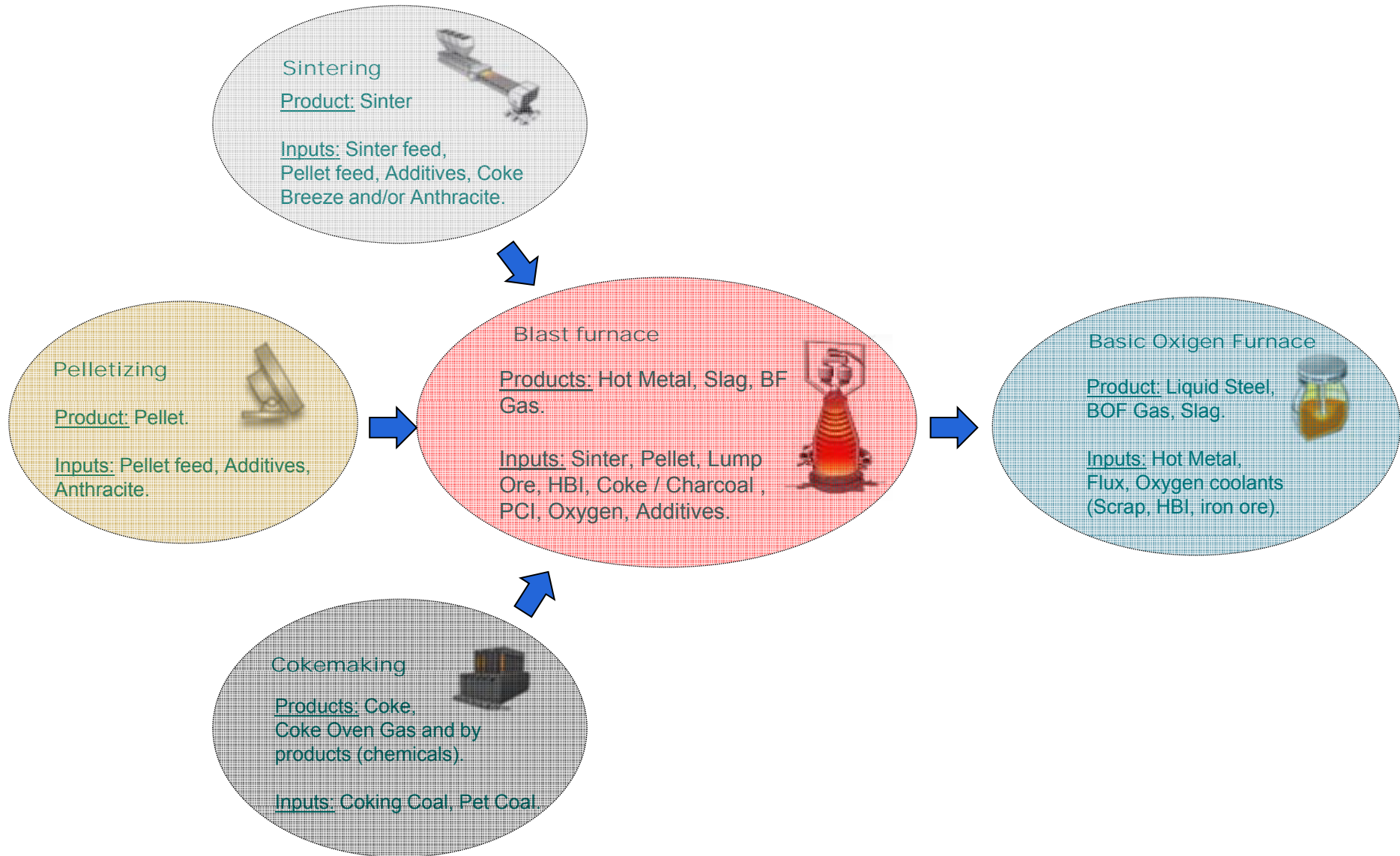


# The impact of iron ore quality in the steelmaking process

Paulo Freitas Nogueira

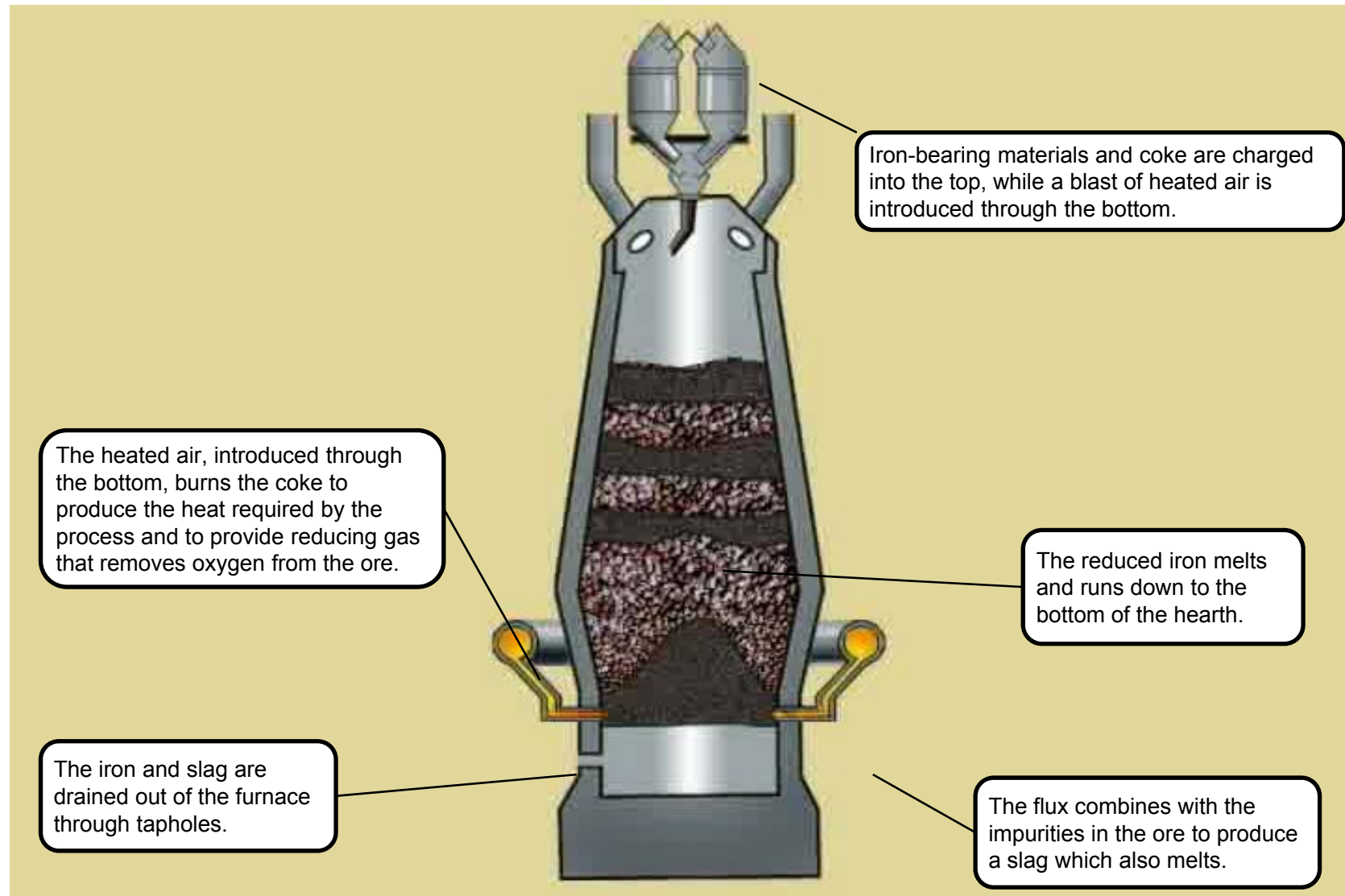
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# THE BLAST FURNACE ROUTE FOR STEEL MAKING





# OVERVIEW OF A BLAST FURNACE PRODUCTION PROCESS



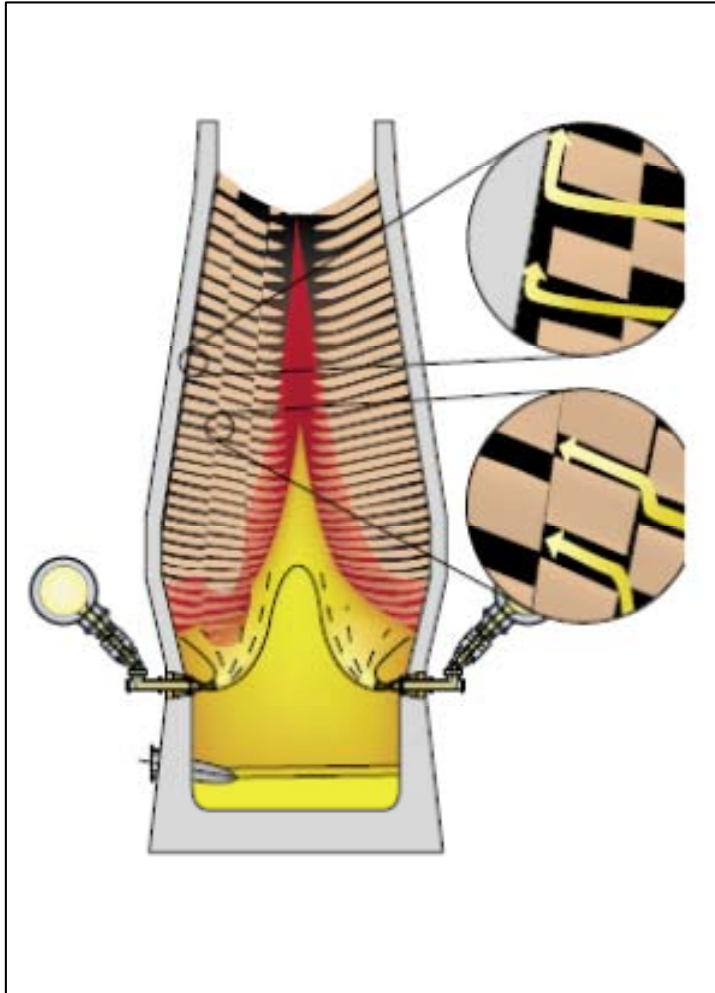
## THE EVOLUTION OF THE BLAST FURNACE



- Blast furnace efficiency improved due to the development in sintering, pelletizing and cokemaking
- Coke and metallic burden improvement allowed blast furnace volume to increase and Opex to decrease

# COKING COAL IN THE BLAST FURNACE

## Coking coal in the blast furnace

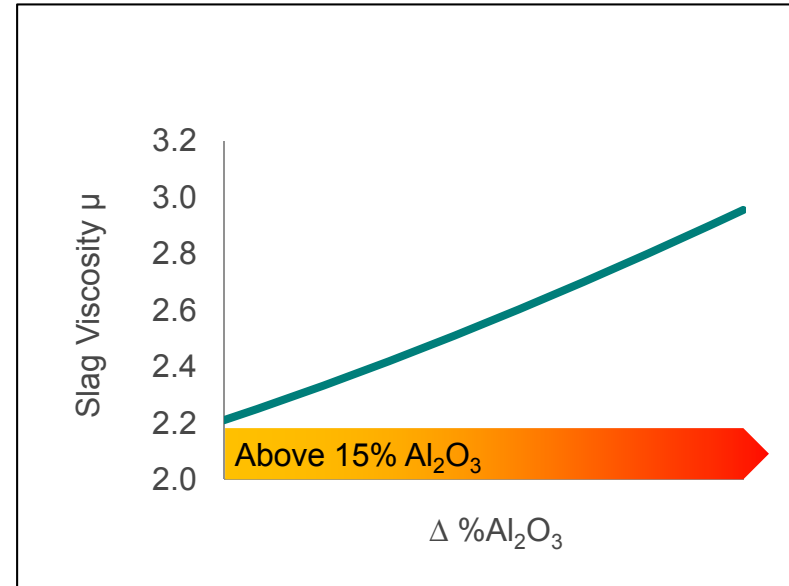
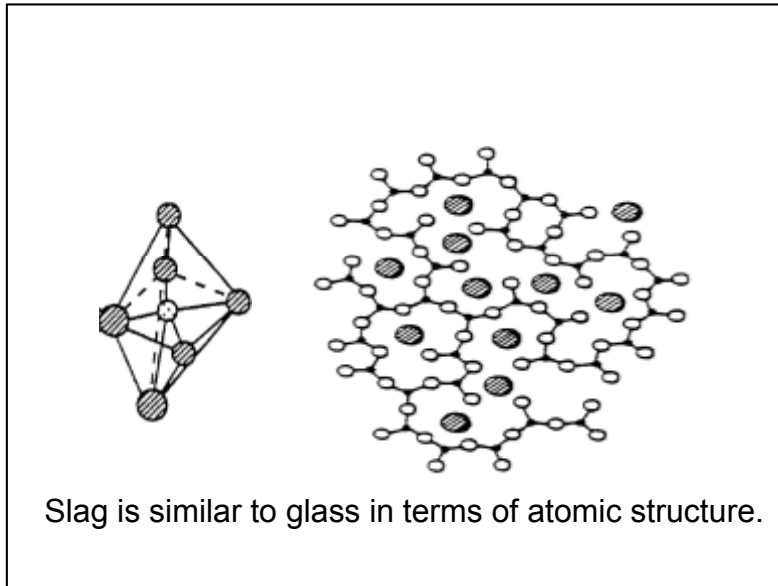


## The role of coking coal

- **Reduction of ore**
  - Carbon removes oxygen from iron ore, producing metallic iron
- **Provision of structural support**
  - Coke retains its strength at temperatures above the melting point of pig iron and slag, providing the structural support that keeps the solid burden materials from falling into the hearth
  - Coke creates a lattice through which gas flows
- **Generation of heat**
  - Carbon in coke (and PCI) is burnt at the tuyeres with oxygen from the blast to generate the heat required by the blast furnace and subsequent processes



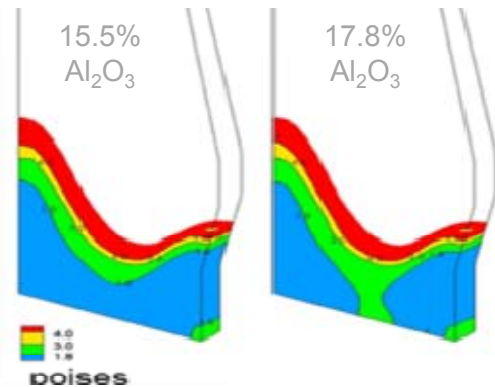
## THE IMPACT OF ALUMINA $\text{Al}_2\text{O}_3$ (1/2)



The higher the  $\text{Al}_2\text{O}_3$  content in the iron ore, the higher the blast furnace slag viscosity restricting gas flow and demanding more coke to preserve process stability.

# THE IMPACT OF ALUMINA $Al_2O_3$ (2/2)

## Blast furnace slag viscosity

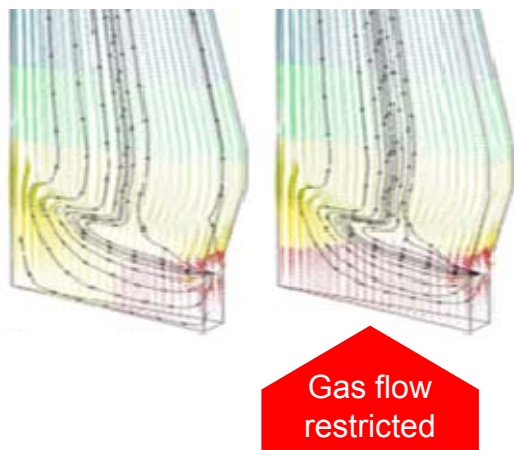


## Higher Hot Metal Cost

	Base case	Higher $Al_2O_3$ after coke rate adjust
Sinter % $Al_2O_3$	1.5%	2.1%
BF Slag % $Al_2O_3$	15.5%	17.8%
Temperature	1617 °C	1622 °C
Coke rate (kg / t hot metal)	342	<b>344</b>

+ 2 kg coke / t hot metal

## Blast furnace gas flow

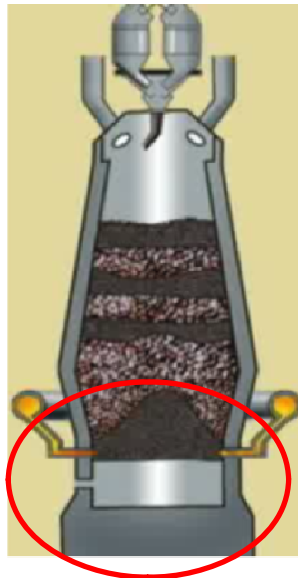


## Impact of $Al_2O_3$ in Blast Furnace

- ↑ Slag viscosity
- ↓ Permeability
- ↑ Coke rate
- ↓ Productivity
- ↑  $CO_2$  emissions



## THE IMPACT OF SILICA SiO<sub>2</sub> (1/2)



Less slag in the burden



More slag in the burden



- The higher the SiO<sub>2</sub> content, the higher the blast furnace slag rate
- Slag occupies hot metal's volume in the furnace, therefore, the more silica charged, the less hot metal is produced



# THE IMPACT OF SILICA SiO<sub>2</sub> (2/2)

Hypothetical case

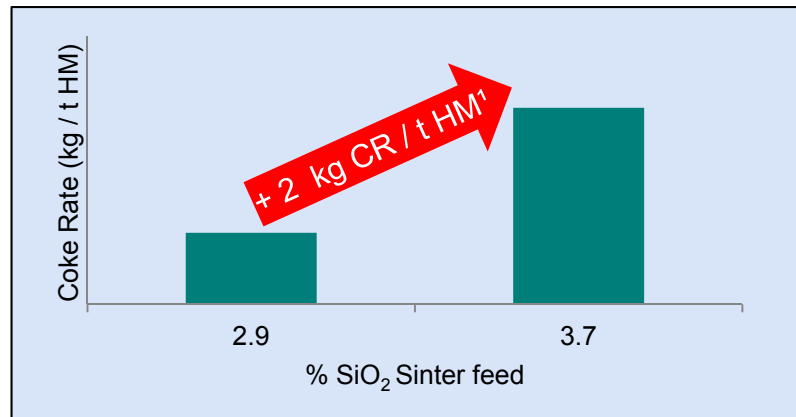
## Hypothetical Comparison

	Sinter feed 65	Sinter feed 62
Sinter feed (% SiO <sub>2</sub> )	2.9	3.7
Additives	175 kg / t	202 kg / t
Sinter (% Fe)	55.9	54.9

## Messages

- As silica content increases, demand for additives in sintering increases to keep basicity constant, increasing consumption of fuel
- Vale's iron ores have the lowest average SiO<sub>2</sub> content among the main global producers

## Coke Rate



## Impact of silica in the blast furnace

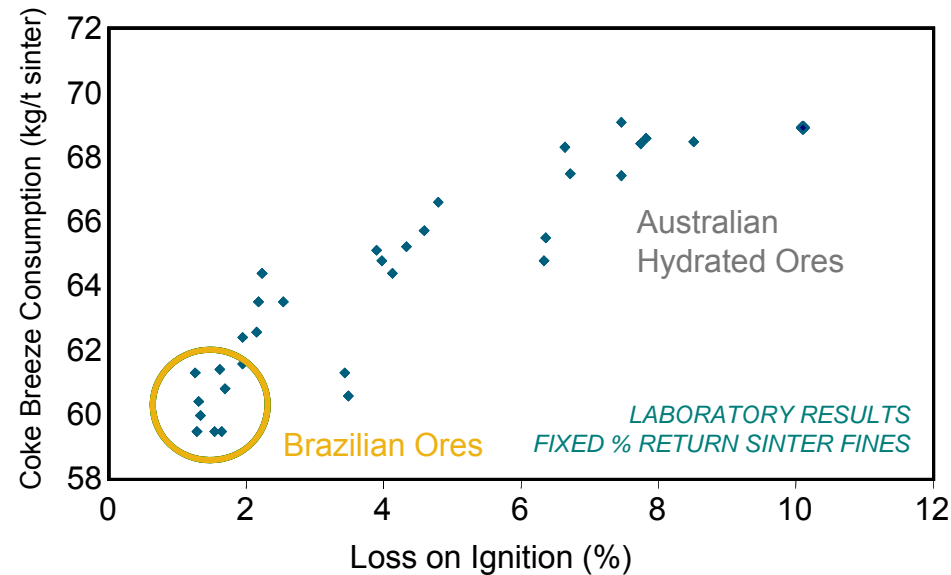
- ↑ Slag rate
- ↑ Coke rate
- ↓ Productivity
- ↑ CO<sub>2</sub> emissions



<sup>1</sup> HM = Hot Metal  
Source: Vale

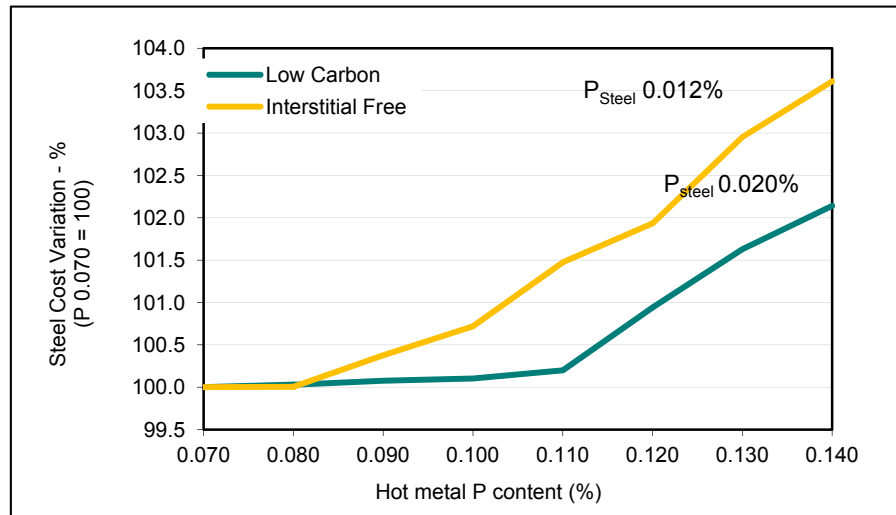
# THE IMPACT OF "LOSS ON IGNITION" (LOI)

## Coke Breeze Consumption



- Vale ores have lower “loss on ignition (LOI)”, which decreases sinter plant fuel consumption and emissions
- Loss on ignition is related to the iron ore hydration degree
- The higher hydrated the ore, the higher the combined water content
- Increase in LOI leads to more coke breeze / anthracite demand

# THE IMPACT OF PHOSPHOROUS (P)



## Impact of Phosphorous

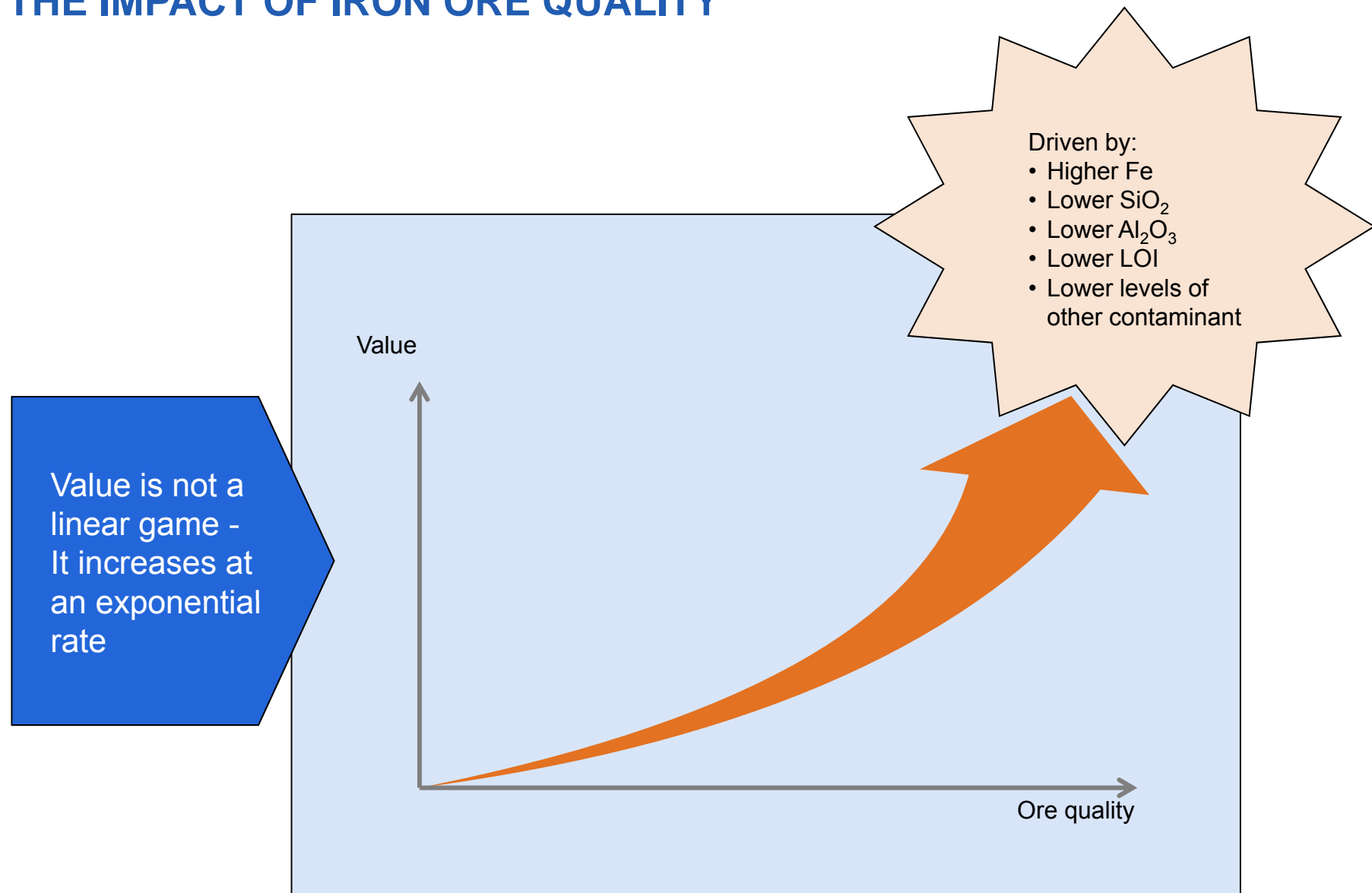
- ↓ Productivity
- ↑ Additives and gases consump.
- ↑ BOF Slag volume
- ↑ BOF temperature



- Vale's Iron Ores have the lowest phosphorous (P) content among the main global producers
- Higher Hot Metal P content demands:
  - Higher additions of fluxing agents, resulting in a highly basic and fluid liquid slag
  - Higher consumption of oxygen – as consequence, productivity decreases



## THE IMPACT OF IRON ORE QUALITY



For a world with new values.



# Investor Tour – Closing Remarks

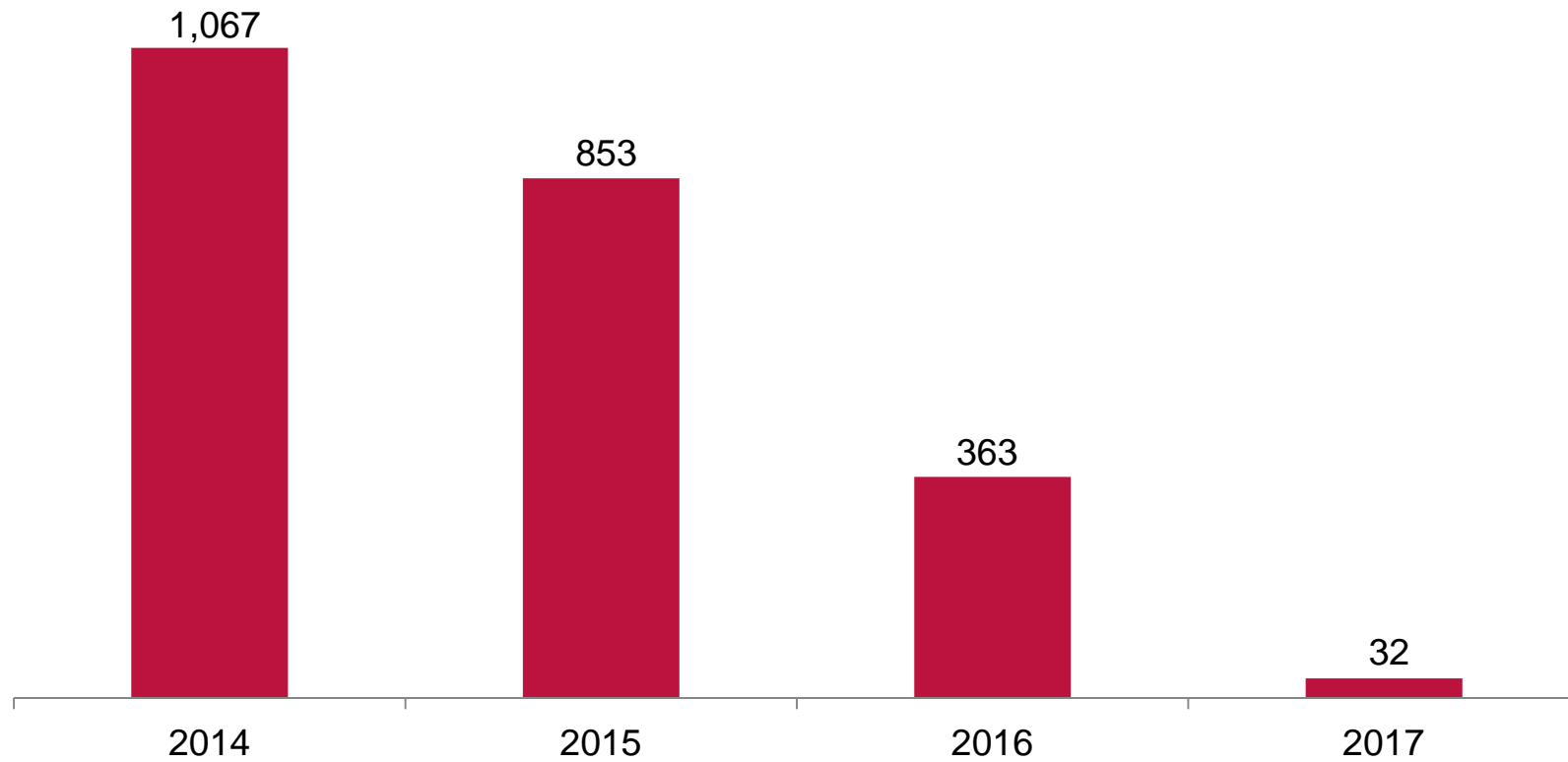
Luciano Siani

Analyst & Investor  
Tour 2014

# CAPEX PROFILE OF THE APPROVED ITABIRITOS PROJECTS

US\$ million

Approved projects only



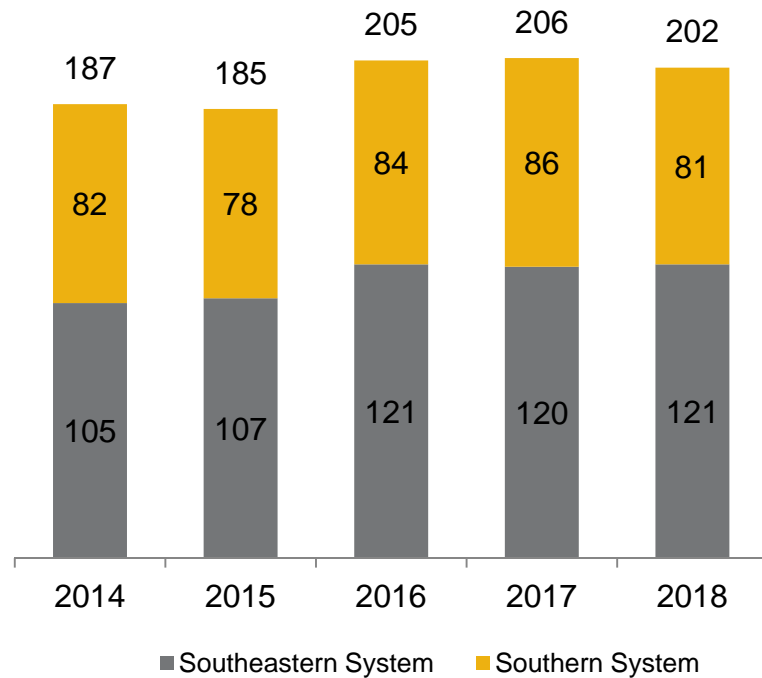


# PRODUCTION AND QUALITY AFTER THE ITABIRITOS PROJECTS

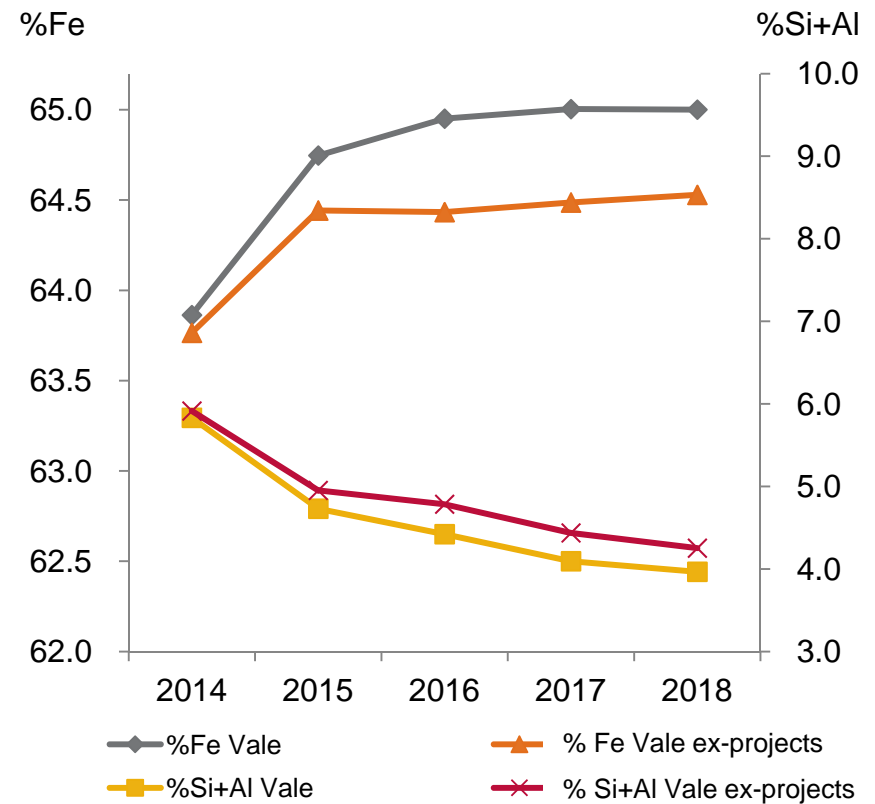
Southern and Southeastern Systems

## Production plan

Mt

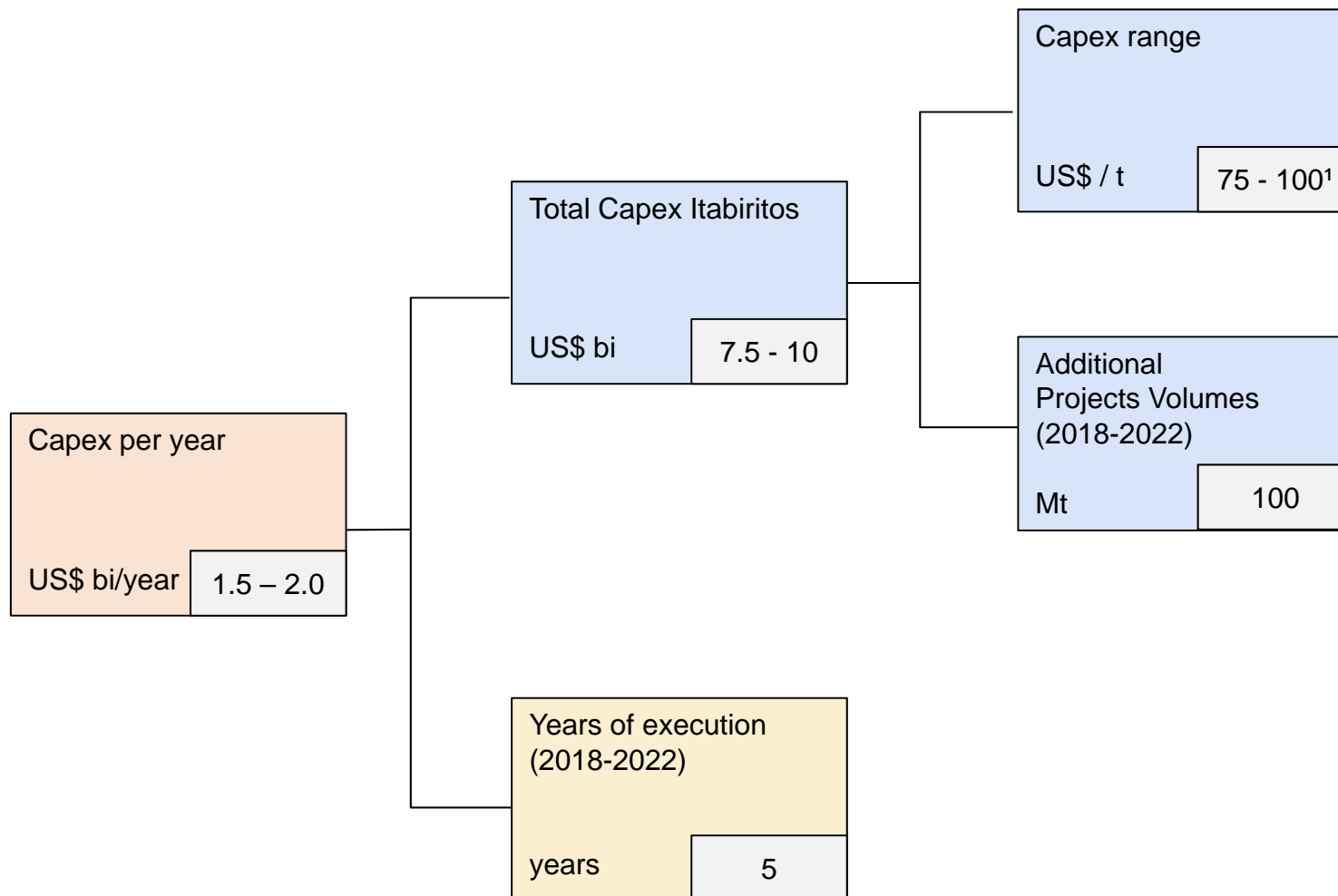


## Quality impact of the Itabiritos projects



## CAPEX PER YEAR – ITABIRITOS PROJECTS

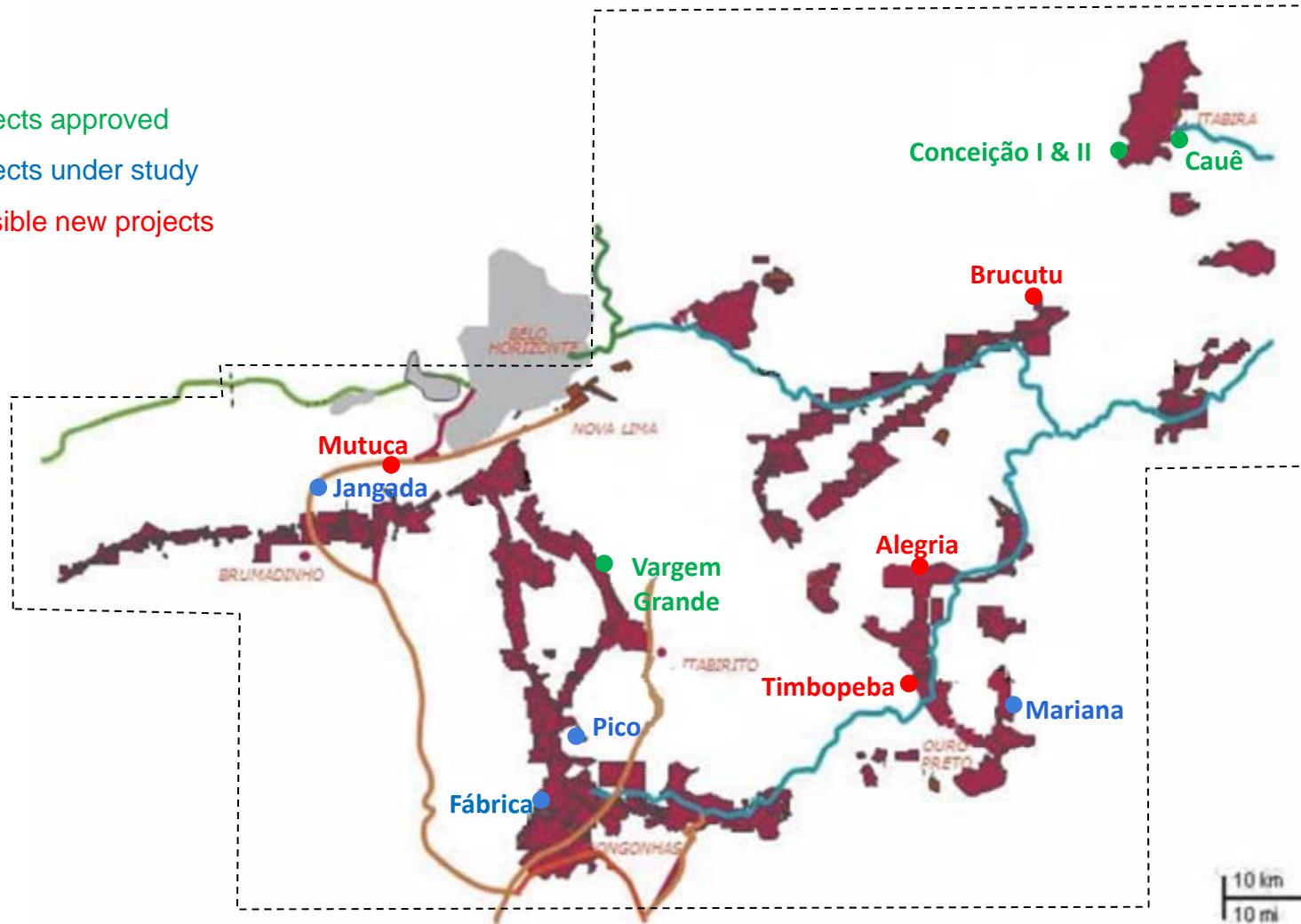
Rough Estimate



<sup>1</sup> Ongoing projects have capex of US\$ 63/t for both Conceição Itabiritos II and Cauê brownfield projects, and of US\$ 98/t for the Conceição Itabiritos I greenfield project.

# ITABIRITOS PROJECTS OPTIONS

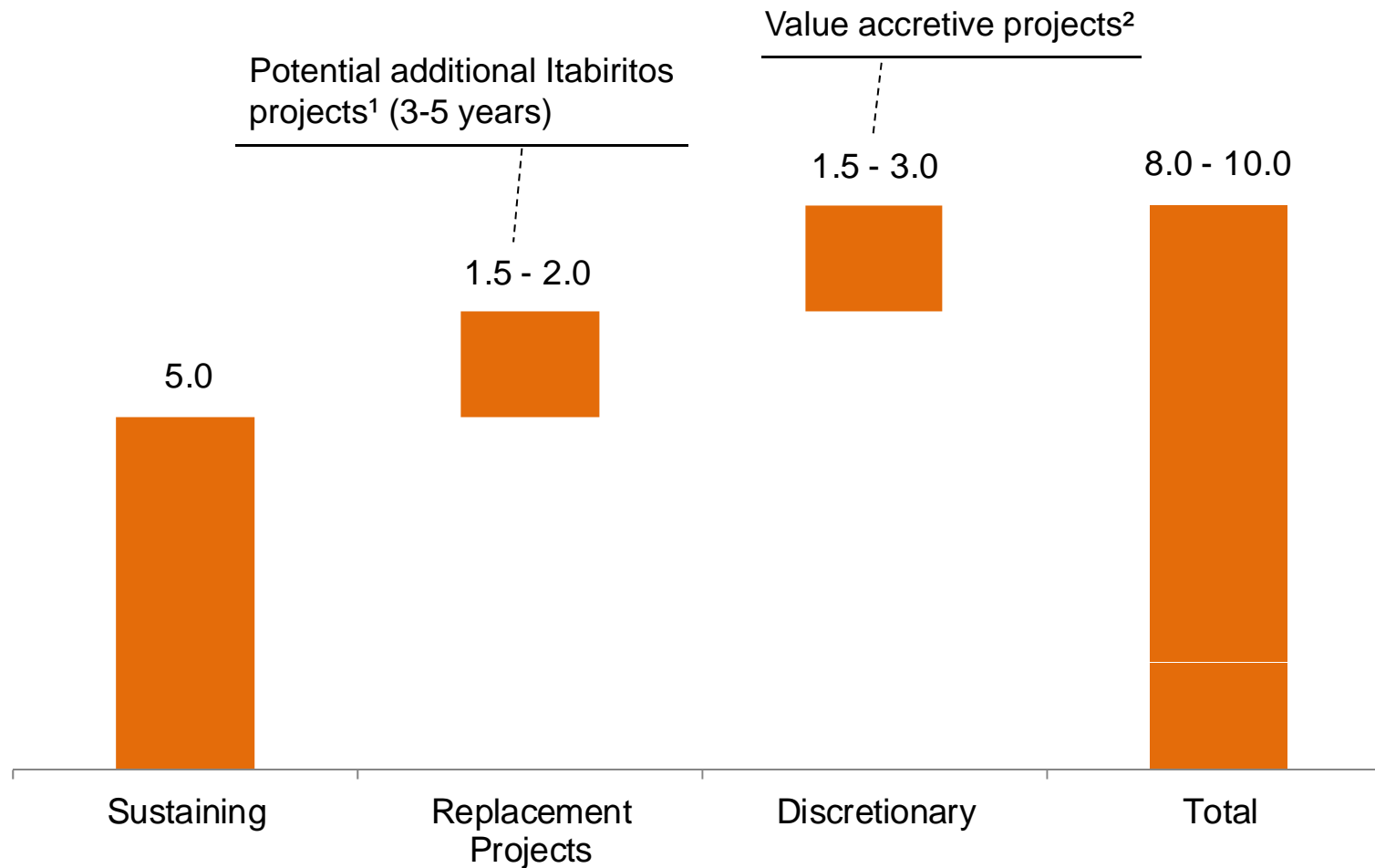
- Projects approved
- Projects under study
- Possible new projects





## PERSPECTIVE ON FUTURE CAPEX (POST-2018)

US\$ bi



<sup>1</sup> Fábrica (26 Mtpy), Jangada (15 Mtpy), Mariana (27 Mtpy) and ITM S Pico (27 Mtpy)

<sup>2</sup> Additional cash flow generation should be considered alongside the above referred capex

For a world with new values.



Analyst & Investor  
Tour 2014