

# RESHAPE YOUR FOOTPRINT

**C/CLAY**  
calcined clay and grinding

THE ULTIMATE EVOLUTION OF PROJECTS WITH C/CLAY IN CALCINED CLAY



# Technical Developments in Calcined Clay Lines

What does a state-of-the-art  
Calcined Clay Line look like?

How did we get here?



**Did you know?**

**more than 20 years of Evolution and Innovation...**

# Brazilian Infrastructure Development

- **First Moment** – Brazilian Infrastructure Development



- What is one of the most suitable cements to be used in these dams? Low Heat Cement



- Typical composition of Pozzolanic Cement in Brazil (cement type CP IV):

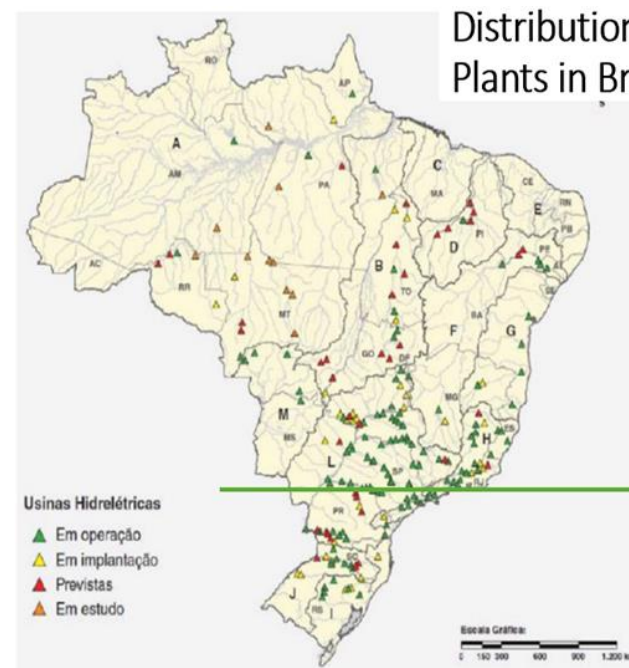
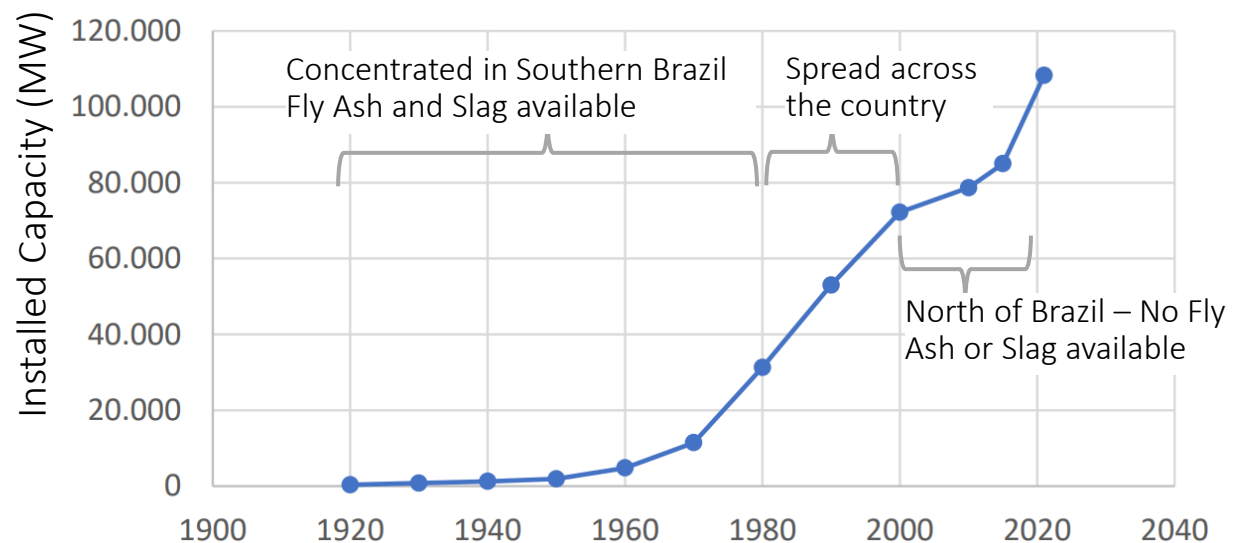
- Clinker: 50%
- Gypsum: 5%
- Limestone: 5%
- Pozzolanic material: 40%

- Fly Ash
- Calcined Clay
- Natural Pozzolana

# Brazilian Infrastructure Development

## ■ First Moment – Brazilian Infrastructure Development

Electricity Generated by Hydropower Plants



Distribution of Hydropower Plants in Brazil

■ Calcined Clay in Center, North and North East of Brazil

■ Fly ash in the South and South East of Brazil

# Client Requests

- **First Moment – In the 80's – First Attempts with Clinker Kilns**
  - **Calcined Clay Production characteristics:**
    - ❑ Incipient production
    - ❑ Use of clinker kilns – satellite coolers
    - ❑ Fuel: heavy fuel oil (HFO)
    - ❑ Material: high kaolinite clay
    - ❑ Operation and Product Obtained:
      - Dust material
      - Uneven quality – under and over cooking
      - Ball and ring formations

## Crude Oil Prices



# Client Requests

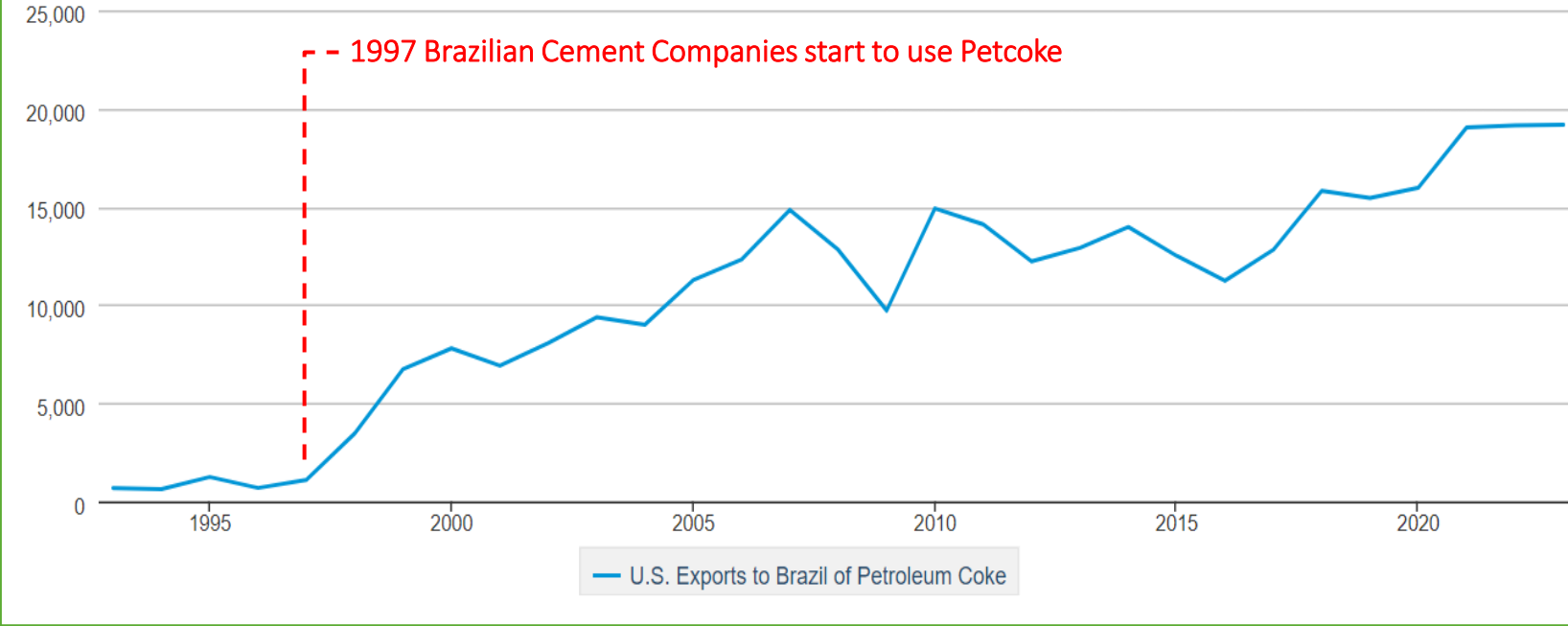
- **Second Moment – In the 90's –**  
First Kilns for Calcined Clay Production

- Characteristics:

- ❑ Production level: 500 tpd
- ❑ Fuel: heavy fuel oil (HFO)
- ❑ Material: high kaolinite clay

U.S. Exports to Brazil of Petroleum Coke

Thousand Barrels



Mid 90's

PETCOKE arises in Brazil

- Petcoke emerges as an interesting alternative for Cement Industries

First Attempts in  
Calcined Clay Kilns

- Combustion Issues –  
FLAME INSTABILITY

Combustion Challenges:

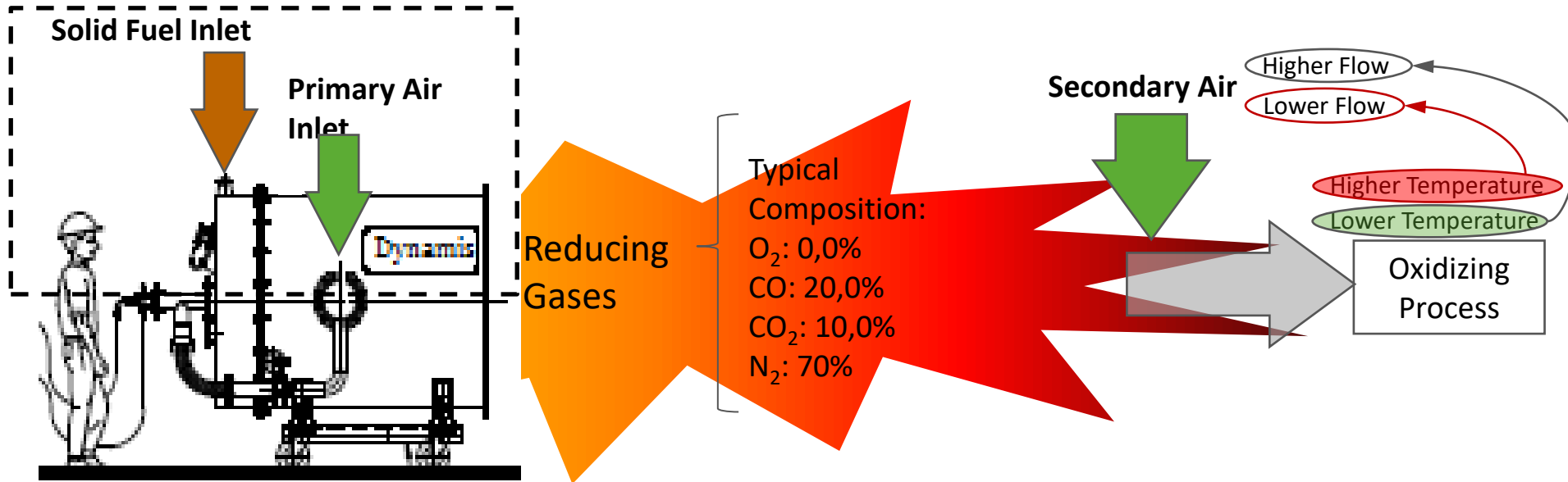
- ❑ Low flame temperature
- ❑ Low secondary air temperature
- ❑ Dusty atmosphere

# DYNAMIS Technical Solution

## D-GASIFIER

### ➤ CONCEPT




Fuel/Air Ratio controlled by BMS - Safety PLC  
– Black Box



# DYNAMIS Technical Solution

## D-GASIFIER

Interesting features for the system:

- Clay calcining temperature control within a tight range  **High Quality**
- Use of solid fuels (100%) in normal operation
  - Coal  **Low Cost**
  - Petcoke
- High-grade fuels (fuel-oil or natural gas) required only for preheating
- Flame stability (even during kiln upset condition)
  - Fast kiln recovery for normal operation
  - Low production of off-spec calcined clay
  - Safety  **Safety**





# DYNAMIS Technical Solution – D-GASIFIER



**C/CLAY** EVOLUTION OF PROJECTS WITH C/CLAY IN CALCINED CLAY

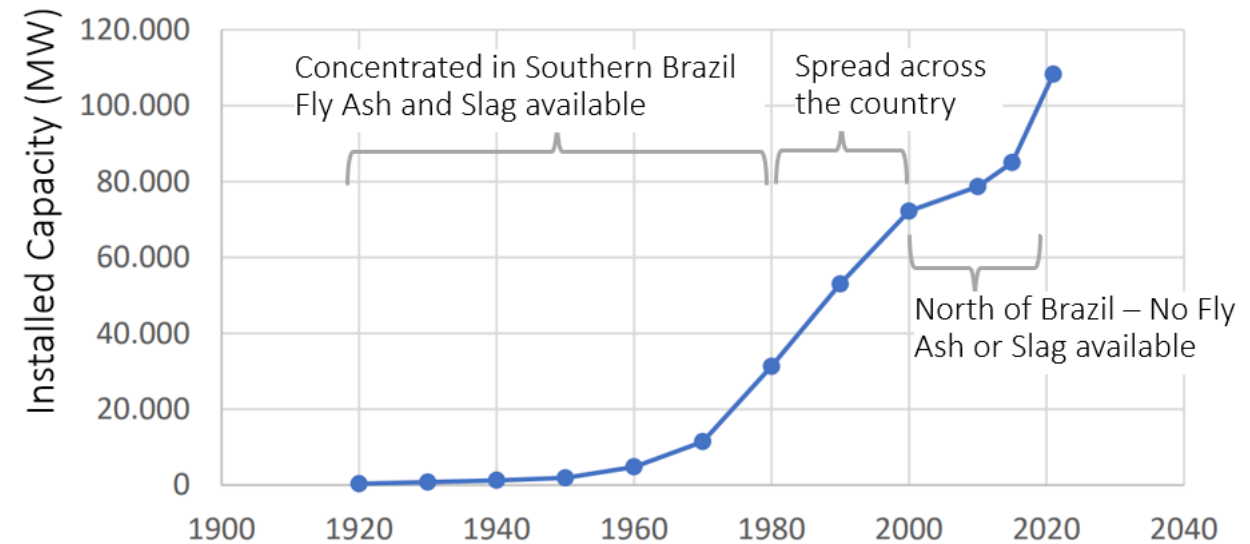


**LOESCHE**   
INNOVATIVE ENGINEERING

# Client Requests

- **Third Moment – In the 2000's** – Three Calcined Clay Kilns erected at same time – New Hydropower Plants – North of Brazil
  - Characteristics:
    - ❑ Higher production (1000 tpd)
    - ❑ Fuel: petcoke
    - ❑ Material: high kaolinite clay

Electricity Generated by Hydropower Plants



# DYNAMIS Technical Solution

## Dynamis' First Reference – Vicat/Ciplan | Sobradinho, Brazil

### PROJECT DATA

Project type	Greenfield Plant
Contract signature	2007
Commissioning	2009
Fuel	Petcoke
Capacity	Original design: 550 t/d After optimization: 700 t/d

### MATERIAL

Raw clay:	Kaolinitic (>70%)
Constitution:	25% moisture (very sticky material)

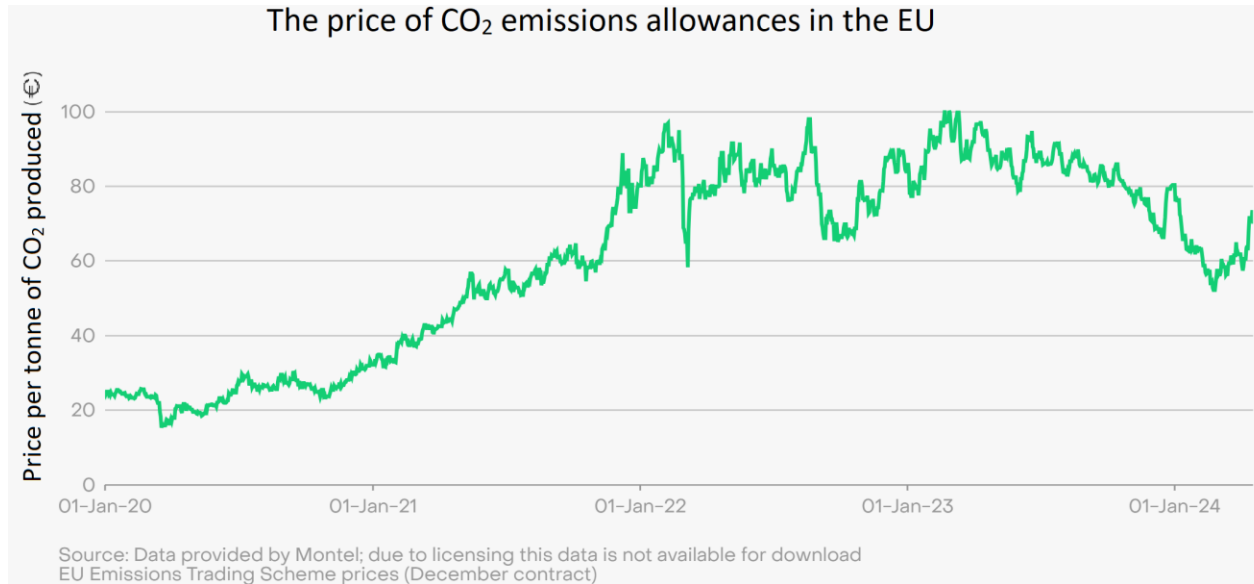
### DESIGN

Technology:	New rotary kiln and rotary cooler, D-Gasifier for solid fuel combustion
Heat consumption:	550 kcal/kg



# Client Requests

- Fourth Moment – In the 2010's – Low Grade Clay
  - Characteristics:
    - ❑ Focus on Environmental Benefits – CO<sub>2</sub> emissions reduction
    - ❑ Higher production (1500 tpd)
    - ❑ Fuel: petcoke
    - ❑ Material:



FLUORESCENCIA (FRX) %										PÉRDIDA ÍGNEA %	HUMEDAD %	DIFRACCIÓN DE RAYOS X %	
SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	CaO	MgO	SO <sub>3</sub>	K <sub>2</sub> O	Na <sub>2</sub> O	P <sub>2</sub> O <sub>5</sub>	TiO <sub>2</sub>	% LOI	% Humedad	CUARZO	CAOLINITA
57,97	19,65	10,05	0,24	0,27	0,01	0,86	0,19	0,17	1,53	8,429	23,16	22,77	32,88

Color Control – MANDATORY

Optimum Calcining Temperature Control – MANDATORY

MATERIAL IS CHALLENGING

# DYNAMIS Technical Solution

## Dynamis' Reference – Cementos Argos | Rioclaro, Colombia

### PROJECT DATA

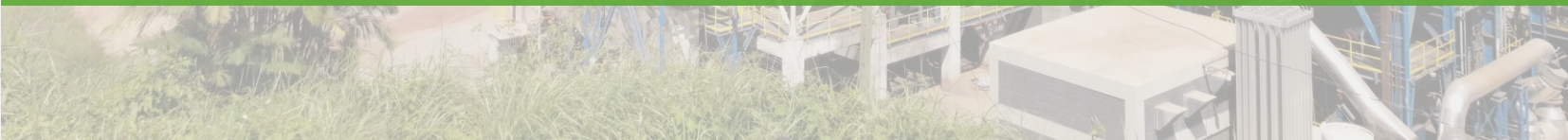
Project type	Greenfield Plant, with an existing kiln from other plant
Contract signature	2017
Commissioning	2019
Fuel	Petcoke and Coal - pulverized
Capacity	1500 t/d

### MATERIAL

Raw clay	Kaolinitic (30% - average)
Iron content	10% (average)
Constitution:	25% moisture (very sticky material)

### DESIGN

Technology:	HYBRID – New Flash Dryer, Existing Rotary Kiln and Rotary Cooler, D-Gasifier
Heat consumption:	570 kcal/kg



# DYNAMIS Technical Solution

Dynamis' Reference – Cementos Argos | Rioclaro, Colombia

COLOR CONTROL TECHNOLOGY



# Client Requests

- Fifth Moment – In the 2020's – AFR and Thermal Efficiency

- Characteristics:

- ❑ Focus on Environmental Benefits – CO<sub>2</sub> emissions reduction
- ❑ Same production (1500 tpd)
- ❑ Fuel: AFR and Biomass
- ❑ Material:
  - Several types of clay:
    - Kaolinite (30 – 50%)
    - Illite (40 – 60%)
  - High iron (> 6%) – **color control required**
- ❑ Heat Consumption: must remain the same (~ 550 kcal/kg)

The New CHALLENGE is again related to COMBUSTION

# DYNAMIS Technical Solution

## Dynamis' Reference – Cimpor | Souselas, Portugal

### PROJECT DATA

Project type	Kiln Modification
Contract signature	2023
Commissioning	2025
Fuel	AFR: 80% Petcoke: 20%
Capacity	1400 t/d

### MATERIAL

Raw clay	Illite (30% - average)
Iron content	7% (average)
Constitution:	20% moisture (very sticky material)

### DESIGN

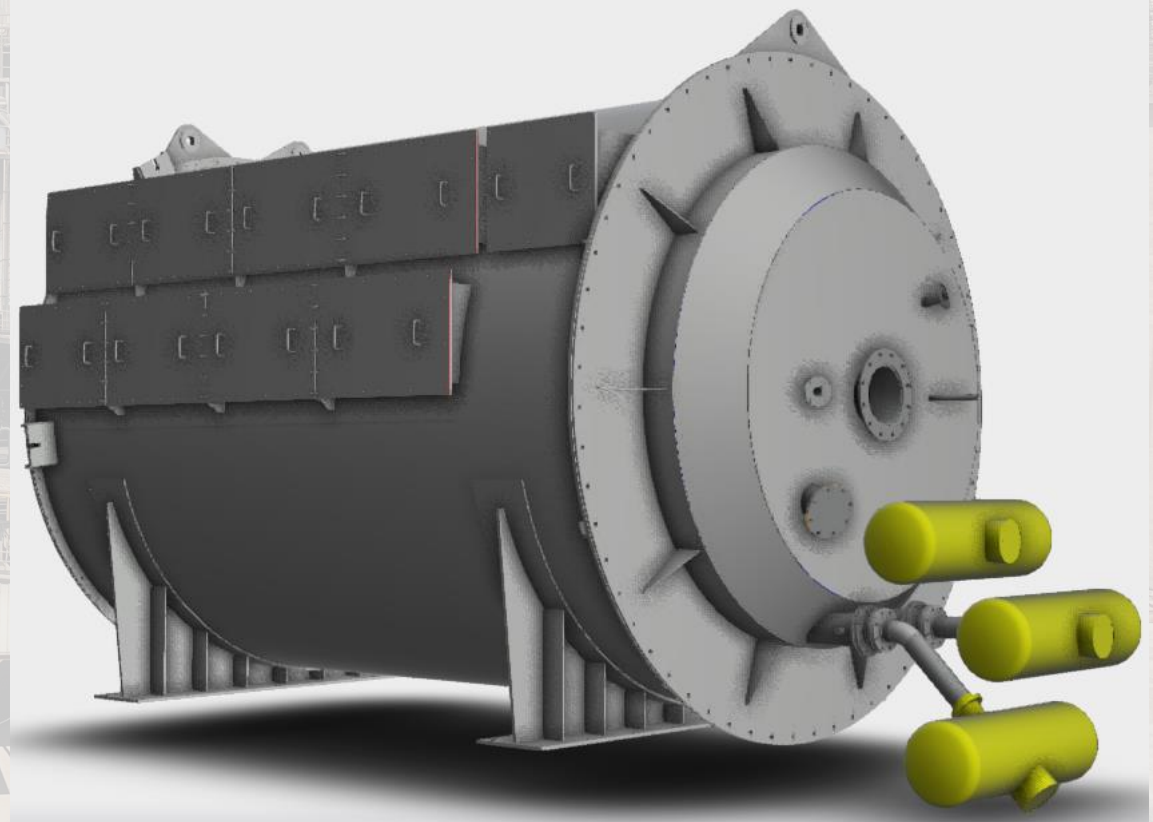
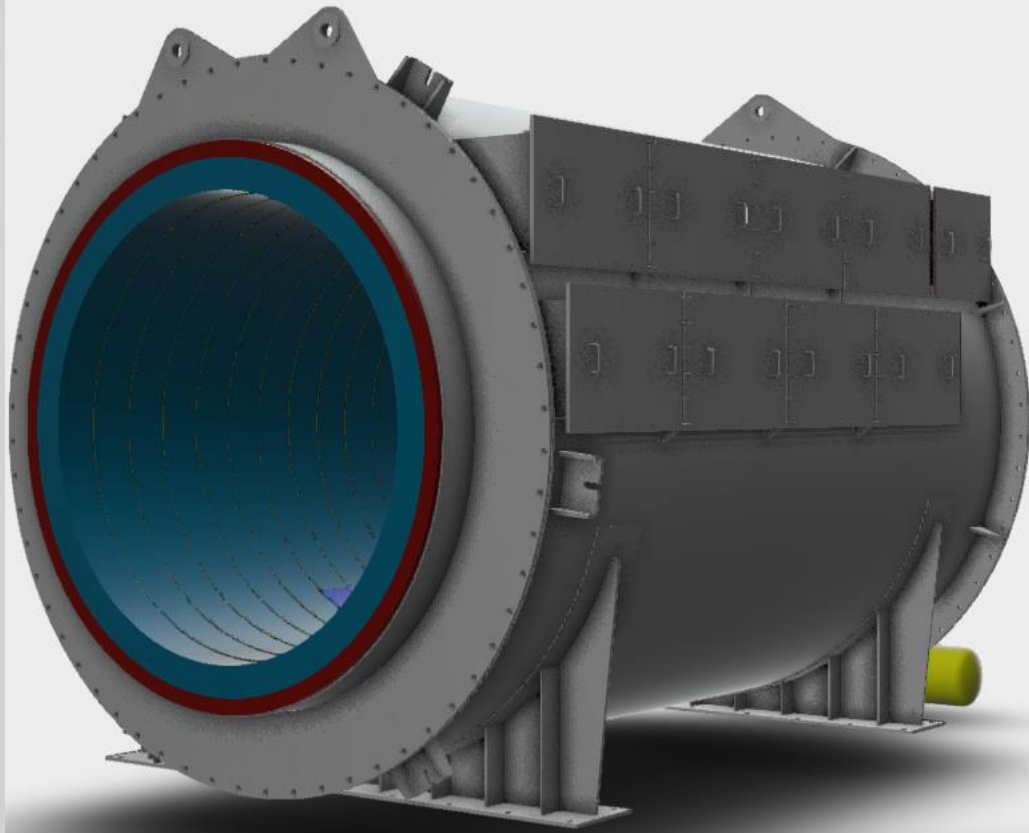
Technology:	Existing Rotary Kiln, Modified Grate Cooler, New Dryer and New D-Gasifier
Heat consumption:	540 kcal/kg





# DYNAMIS Technical Solution

Dynamis' Reference – Cimpor | Souselas, Portugal



D-GASIFIER AFR Pro

# DYNAMIS Technical Solution

Dynamis' Reference – Votorantim | Pecém, Brazil

## D-FBED Chamber

### PROJECT

Contract signature	2019
Commissioning	2021
Type	FLUIDIZED BED
Thermal load	12 Gcal/h, as HGG 30 Gcal/h, as GASIFIER
Fuel	BIOMASS: 0 – 100% Petcoke: 0 – 100%
Fuel Granulometry:	BIOMASS: < 30mm Petcoke: < 10mm
Fuel Moisture:	BIOMASS: < 20% Petcoke: < 10%



# Technical Developments in Calcined Clay Lines

What does a state-of-the-art  
Calcined Clay Line look like?



Did you know?

- Flash Calciner or Rotary Kiln
- Control of the Calcining Temperature in a very tight range – Quality
- Color Control Technology
- Burning Alternative Fuels – TSR 50% plus
- Cooler able to provide secondary air at high temperature

# Technical Developments in Calcined Clay Lines



**Research and Development continuous....**

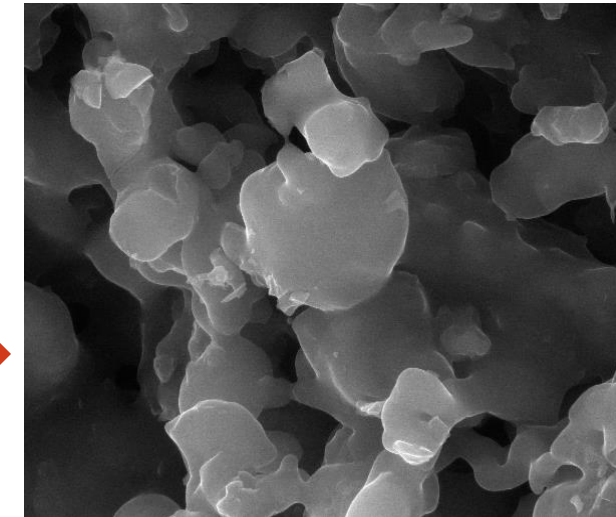
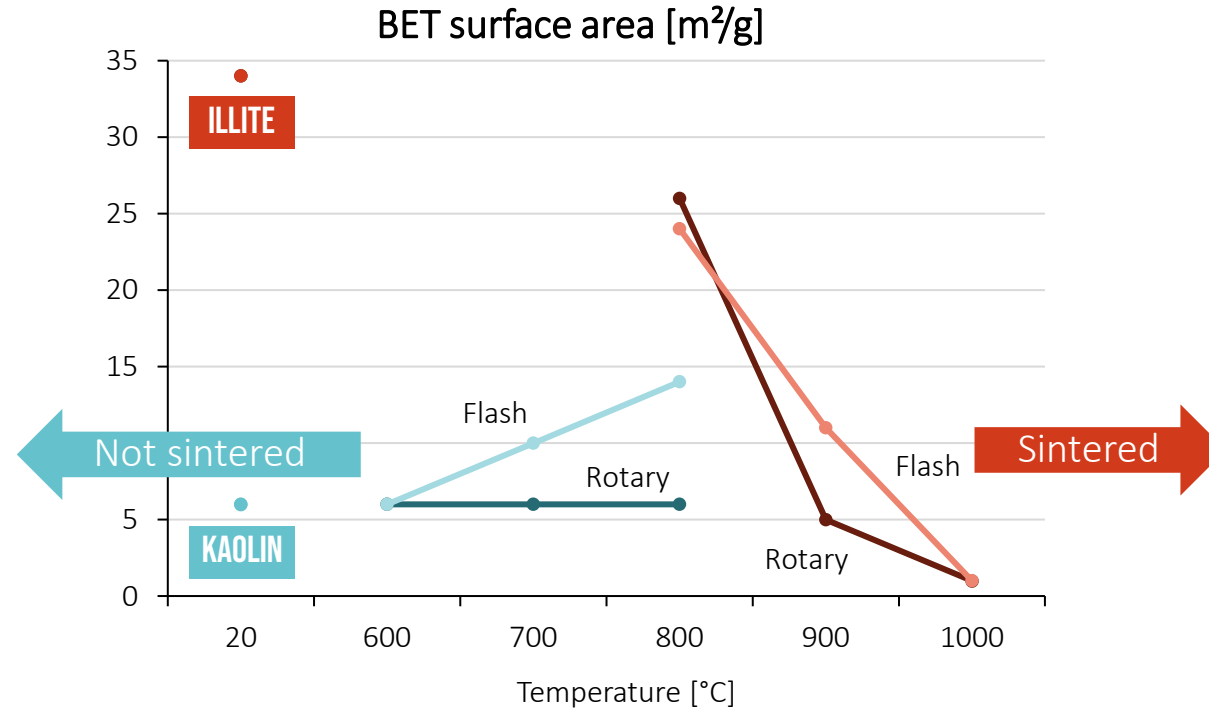
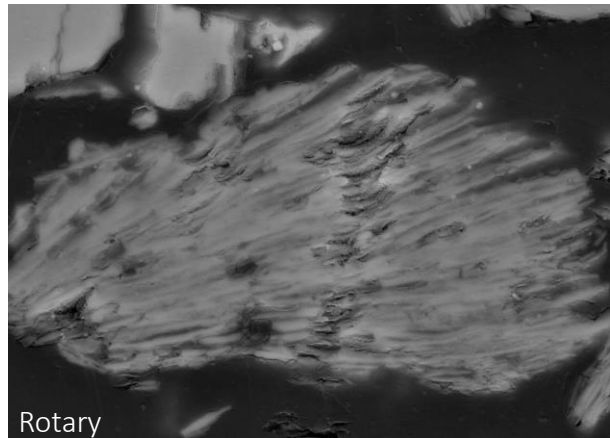
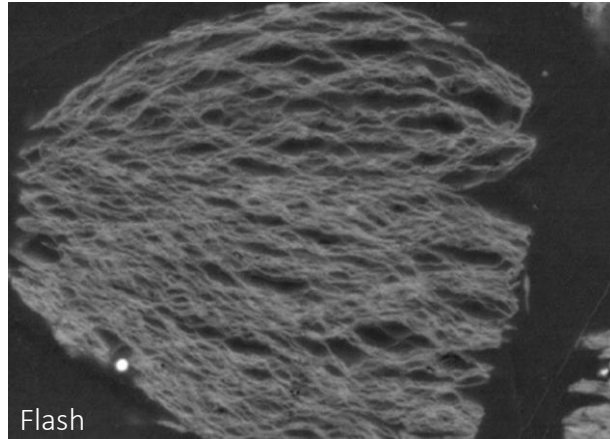
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**C/CLAY** EVOLUTION OF PROJECTS WITH C/CLAY IN CALCINED CLAY

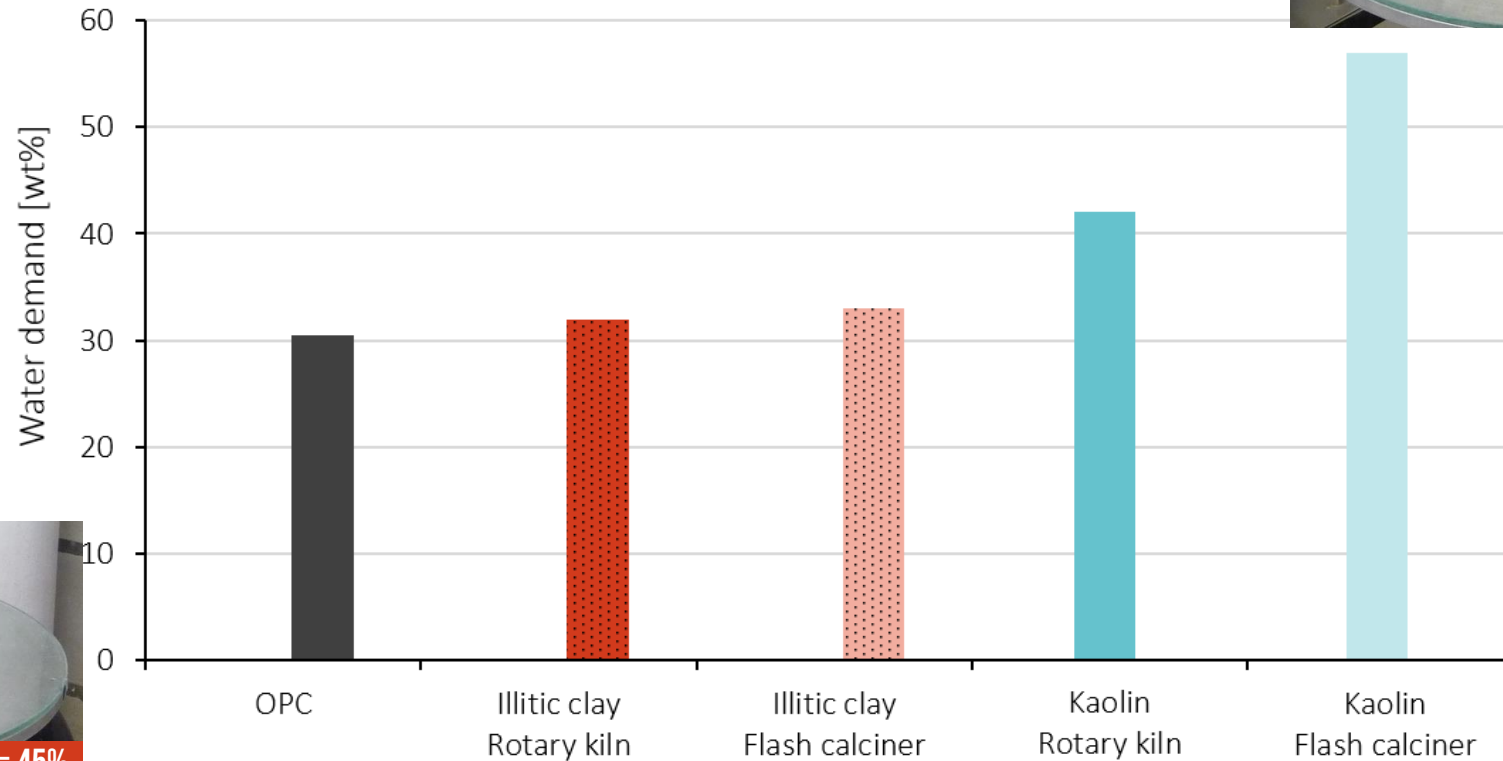


# Water Demand Control Technology



# Water Demand Control Technology

Water demand of blended cements  
(30% clinker replacement)



Grinding

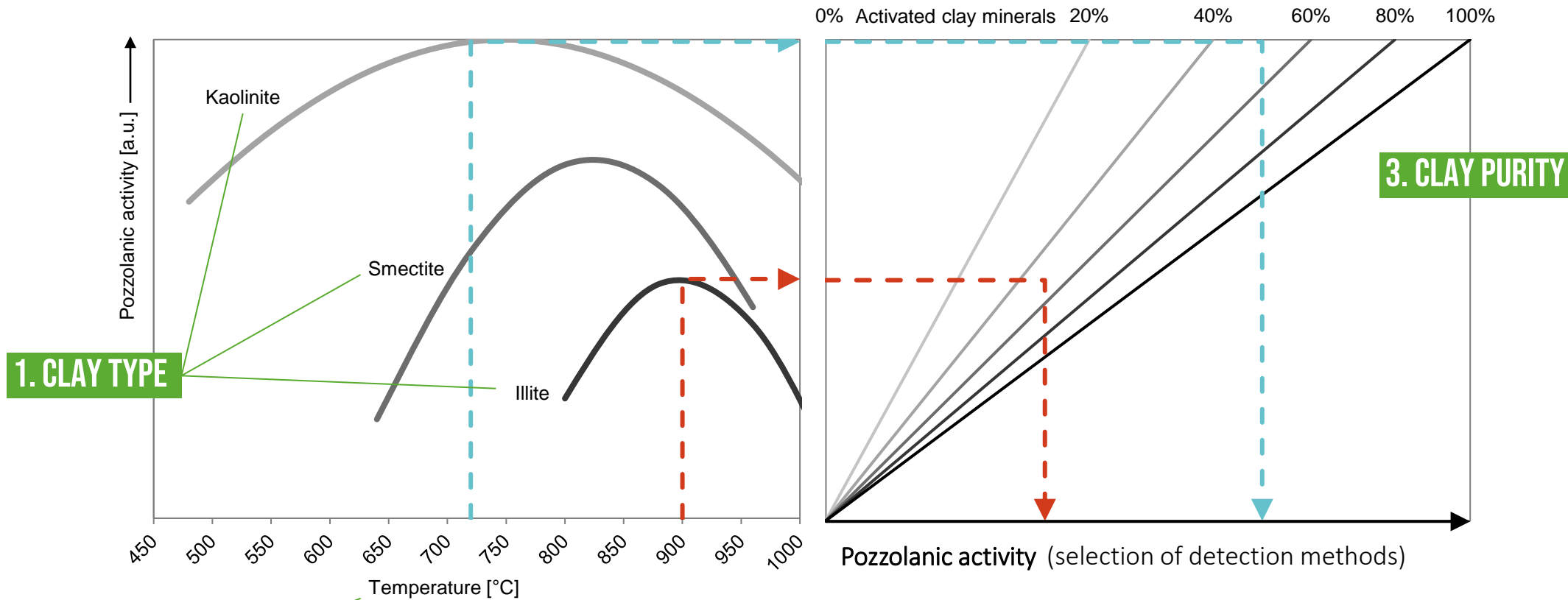


KAOLINITE = 80%



ILLITE = 45%

# Water Demand Control Technology





THANK YOU!

THE **WORLD'S LARGEST** CALCINED CLAY PLANT

Cementos Argos – Rioclaro, Colombia

