

# polysius® activated clay

a polysius solution to decrease the clinker factor down to 50 %

## Overview presentation

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thyssenkrupp Industrial Solutions AG, Business Unit Cement Technologies



polysius®  
activated  
clay

# Introduction





# #grey2green – the green polysius<sup>®</sup> cement plant

polysius<sup>®</sup>  
Waste heat  
recovery

polysius<sup>®</sup>  
fuel substitution

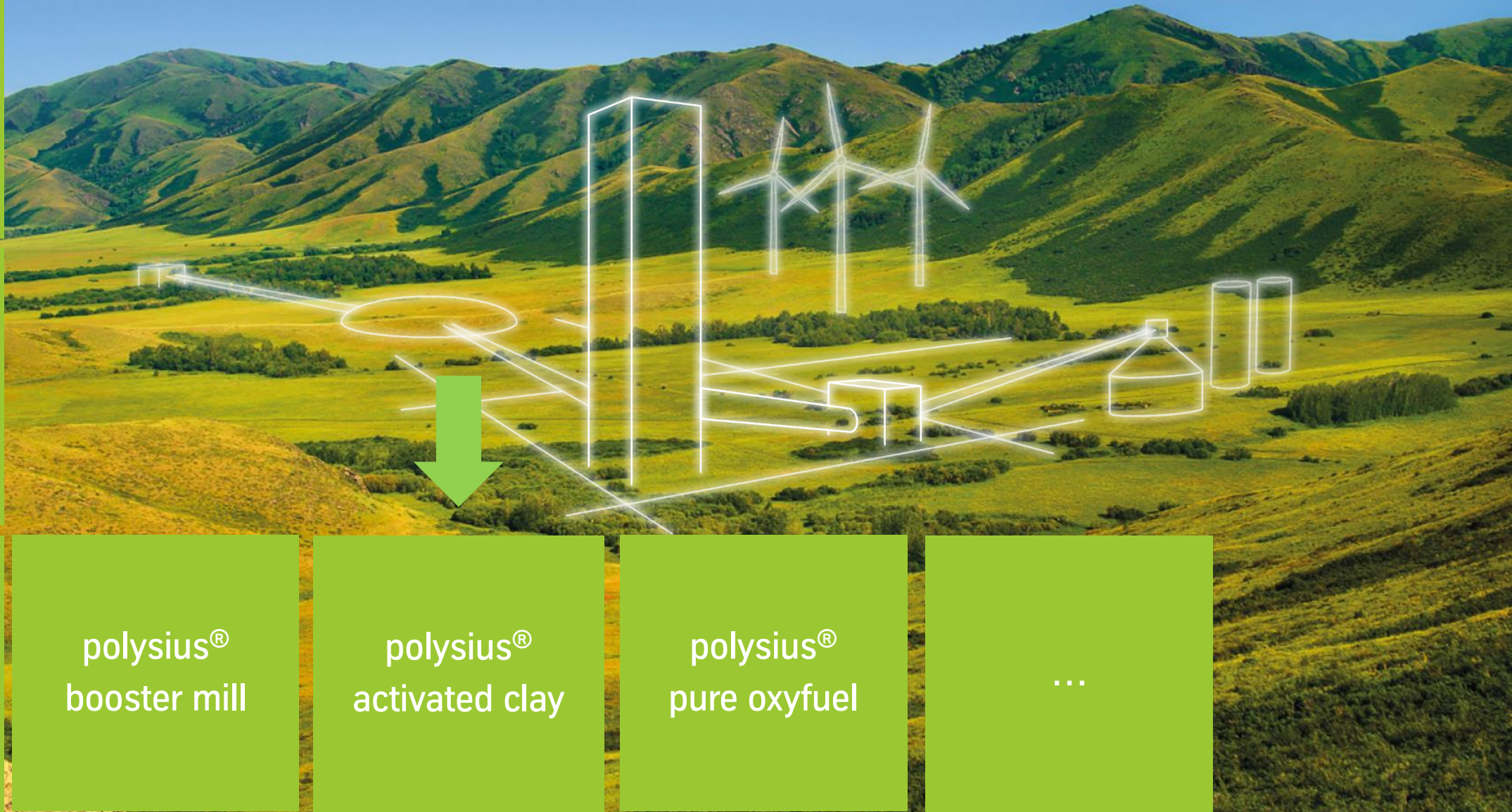
polysius<sup>®</sup>  
NOx reduction

polysius<sup>®</sup>  
booster mill

polysius<sup>®</sup>  
activated clay

polysius<sup>®</sup>  
pure oxyfuel

...



# Which are the market drivers for the cement industry applying an activated clay plant?

## Drivers for activated clay...

An activated clay  
plant by



thyssenkrupp ...



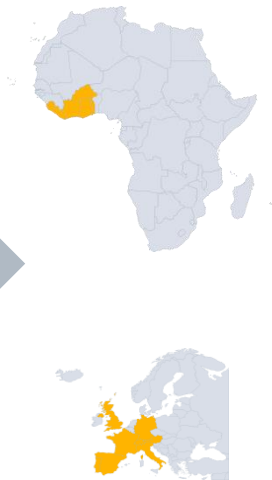
... high clinker costs ✓

... sold out cement market ✓

... CO<sub>2</sub> reduction ✓

## ...are applicable in different regions

reduce the clinker factor



Activated clay contributes to a higher competitiveness and sustainability of a cement producer



# Usable raw clay quality

First indicators for using a clay as new SCM

## Physical parameters

- ✓ Sedimentary & weathered clays with impurities
- ✓ Even deposits possible
- ✓ High moisture contents of clays

## Chemical parameters

1	$\text{Al}_2\text{O}_3$
	> 18%
2	$\text{Al}_2\text{O}_3 / \text{SiO}_2$
	> 0,3
3	LOI
	> 7,0%

## Mineralogical parameters

### Example 1

#### Limestone cement replacement by PPC

Kaolinite content ~10-20%

e.g. reduction of clinker content down to 65%  
(65% clinker - 30% act. clay - 5% gypsum)

### Example 2

#### OPC replacement by Ternary Blends

Kaolinite content ~40%

e.g. reduction of clinker content down to 50%  
(50% clinker - 30% act. clay - 15% limestone – 5% gypsum)

### Note

- Other clay minerals than Kaolinite can be activated as well
- Mixed clay minerals can be fully activated

Indicative figures – detailed analysis for each clay needed in the LAB





# How to activate a clay?

Thermal activation of e.g. kaolinite in a determined temperature range produces metakaolinite – a high quality SCM

## Activated clay as an Supplementary Cementitious Material (SCM)

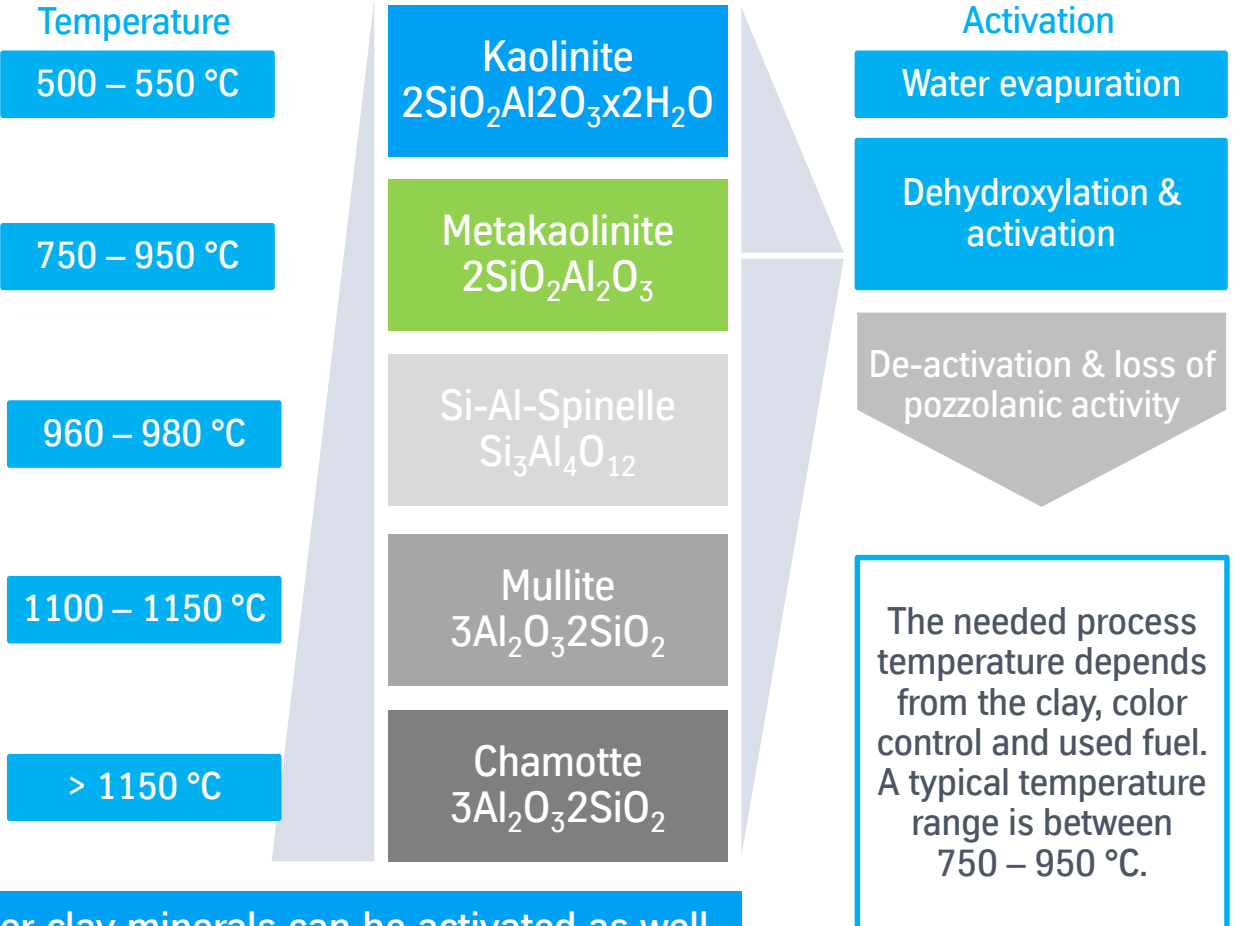


**Origin of kaolinitic clays:**  
Widespread in clay deposits, often overburden of kaolin mines or residue from aggregate quarries with different principal materials



**Potential of kaolinitic clays:**  
Many deposits are not used today because of only low-grade kaolinitic content, not suitable for e.g. paper or ceramic industry, but well for activated clays as an SCM

## Principle of reactions for activated clay production based on Kaolin



Metakaolinite is the most important constituent in activated clay – other clay minerals can be activated as well

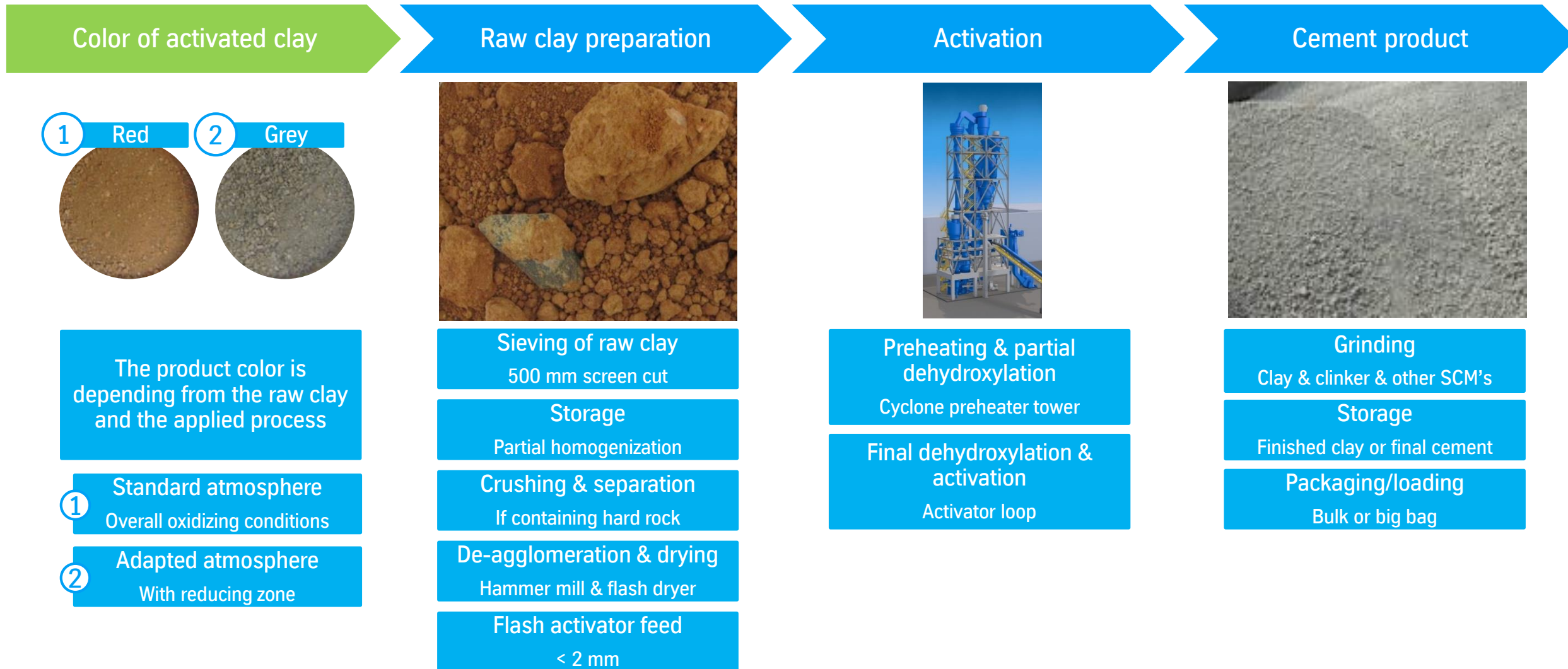


# tkIS technology



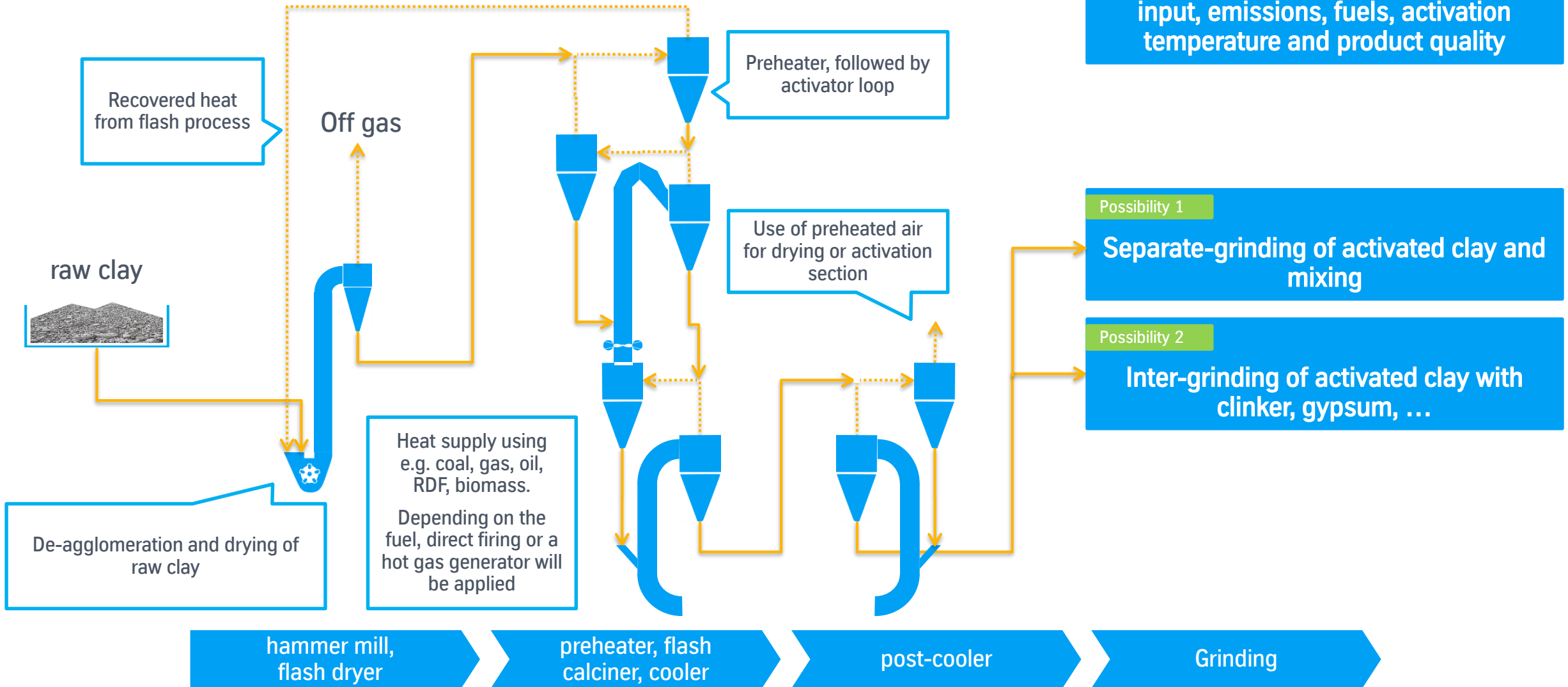
# Basic process of clay activation in an industrial plant

From the quarry to activated clay





# General flow sheet of a flash activation process



# Project approach



# From best clay deposit to best quality product

We support you all along the value chain

Business  
case  
service



**GEO service: Sampling of suitable clays**



Gate 1 – Start of LAB services with collected samples



**LAB Service package 1: Basic clay assessment**

PSD, density, moisture, XRF, LOI, XRD, TGA, emissions, ...



Gate 2 – Continue with clays assessed as suitable



**LAB Service package 2: Cement quality forecast**

Small scale activation, cement, quality assessment & optimization



Gate 3 – Continue with clays showing good quality results



**LAB Service package 3: Pilot scale flash activation**

Activation in polcal, cooling parameters, wear tests, process selection, ...



Gate 4 – Selected clays suitable for large scale installation



**Technical concept & plant design**





# tkIS technology center Germany





# Trials for conclusions and assurance of clay and cement quality

Raw material analysis, semi-industrial test production and mortar tests in R&D center



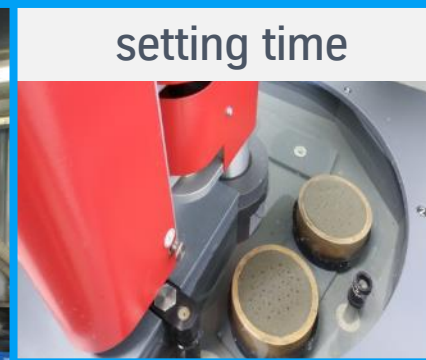
polysius® flash calciner



polysius® quadropol



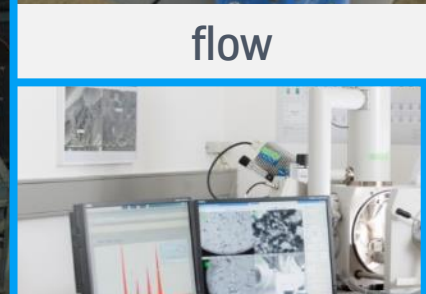
polysius® ballmill



setting time



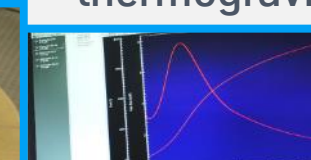
flow



SEM



thermogravimetric



calorimetry



strength



XRD/XRF



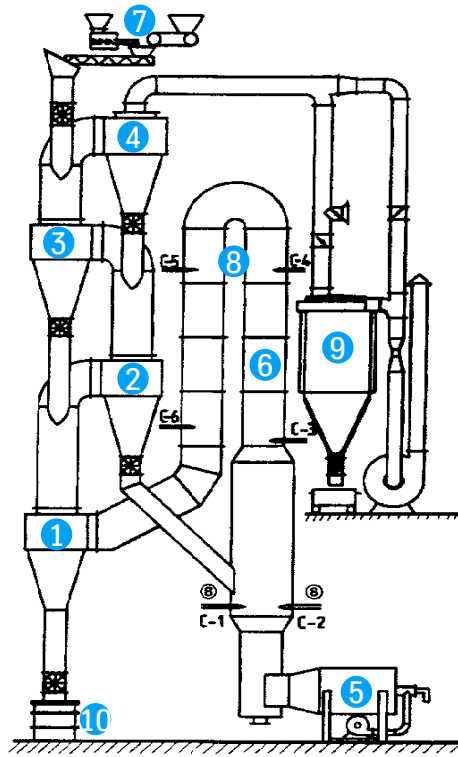
network





## LAB service

### Pilot scale flash activation using polcal 2



- |                                    |                       |
|------------------------------------|-----------------------|
| 1 – 4 Preheating Cyclones          | 8 Separate gas burner |
| 5 Combustion chamber (natural gas) | 9 Bag filter          |
| 6 Calcliner duct                   | 10 Product discharge  |
| 7 Weigh belt feeder                |                       |

Color control in pilot scale



Two LAB flash calciners to activate clays | 50 kg/h and 500 kg/h | 20 tons of clay activated for a customer





# Next steps

How to go on with your individual project?



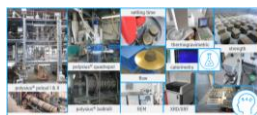
## Input: Data sheet

Kiln Plant Questionnaire	
Contact information	Plant name
Plant address	Plant type
Contact person	Contact person
tel. number	email
Date of filling	
000 project number	

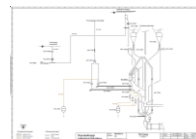
## Business cases



## polysius® LAB services



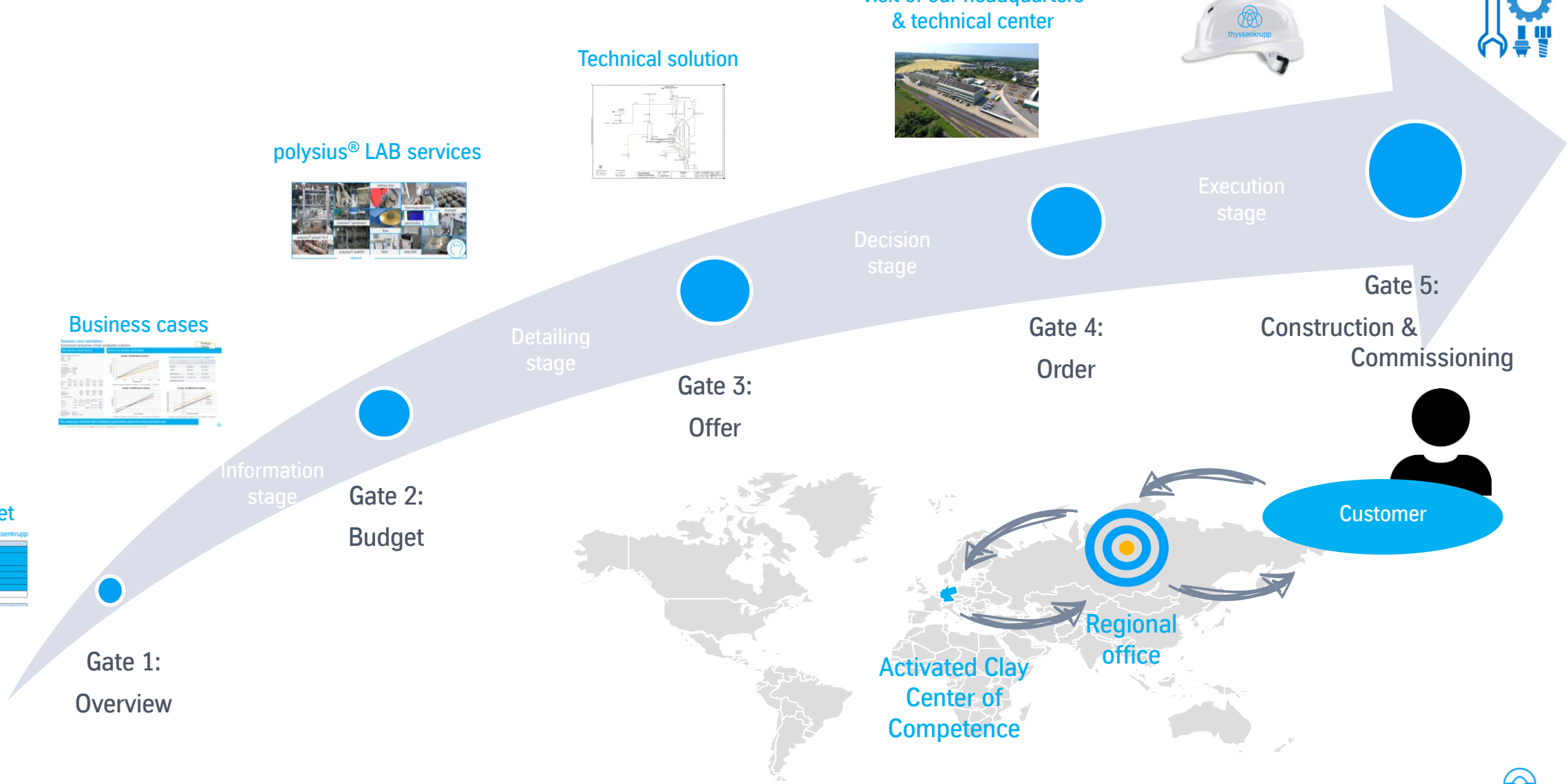
## Technical solution



## Visit of our headquarters & technical center



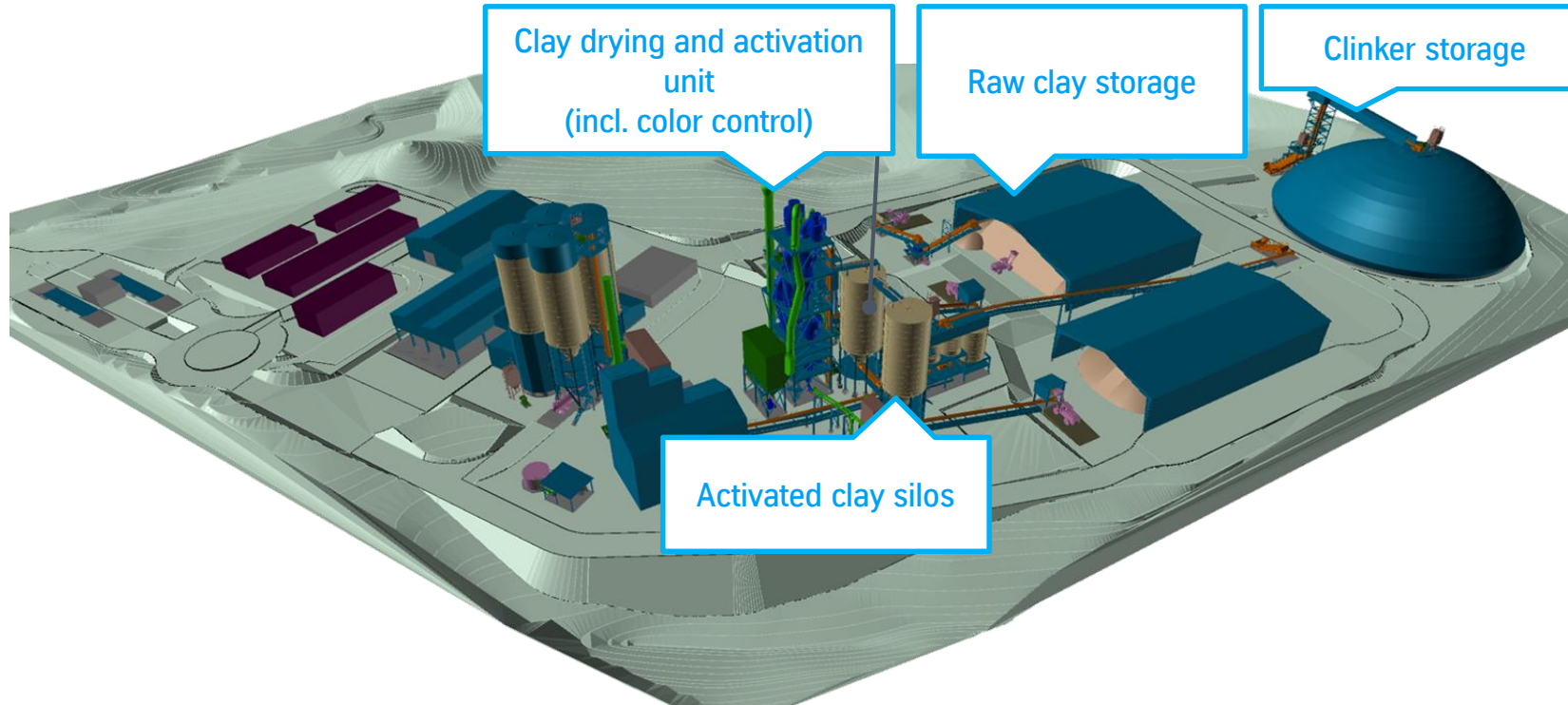
## Supervision



# Reference



# New industrial-size flash activation process under construction by Polysius



## Basic data

- Flash activation unit
- Grinding plant
- EPC turn key project including coal grinding, storage and material handling facilities
- Raw material with coarse hard rock particles, high moisture and iron content
- Color control using coal

Key to success was an intense support with GEO/LAB services and the development of the most competitive solution





# References on flash calcination technology: Koniambo Nickel S.A.S, New Caledonia

## Nickel ore drying and calcination with POLCAL flash technology



Customer:	Koniambo Nickel S.A.S
Location:	Kone, New Caledonia
Feed material:	Nickel Laterite Ore, max. 35% Moisture
Process:	Hammer Mill, Flash Dryer & Flash Calciner, Flash cooler
Temperature:	1000 °C
Fuels:	Coal, Oil, Off-gas recycling
No. of lines:	2
Capacity:	3840 tpd per line pre-heated & calcined ore



# References on flash calcination technology: Navoi Mining, Uzbekistan

## Phosphate rock calcination with POLCAL flash technology



Customer:	Navoi Mining and Metallurgical Combinat
Location:	Uzbekistan, Navoi
Feed material:	Phosphate Rock – 2 x 1300 tpd
Process:	Hammer Mill, Flash Dryer, POLCAL Pre-heater & Flash Calciner, Flash cooler
No. of lines:	2 (2000, 2014)

### Project Notes :

The process design was based on test work at the R&D center of TKIS and conducted acc. to special needs of the feed material.

The project consisted of a calcination plant for phosphate rock applying hammer mill, flash dryer followed by POLCAL flash calcination and flash cooler for heat recuperation.

In 2012 the contract was signed for a second line.



# #grey2green

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