LIME Hydrating Process

CIMPROGETTI®
THE GREEN EDGE OF
LIME TECHNOLOGIES

LIME

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To

Hydrated Lime

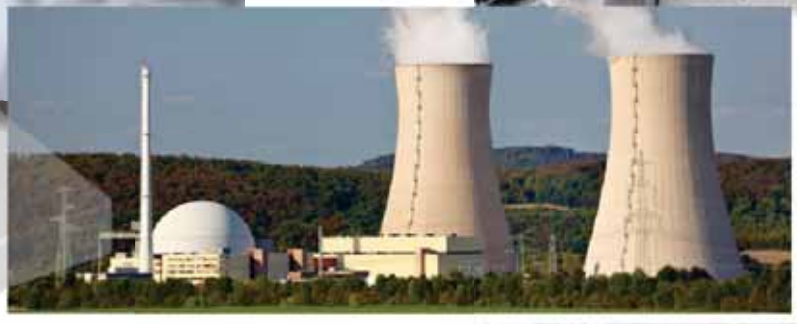
Hydrated lime is the second most relevant commodity of the lime industry.

Hydrated lime (calcium hydroxide) is a dry powder produced combining quicklime with an amount of water to satisfy the quicklime's natural affinity for moisturing.

$$CaO + H_2O = Ca(OH)_2 \uparrow HEAT$$

Hydrated lime is the option for lime producers to enhance the market spectrum. Hydrated lime is much easier to handle and the consistent quality gives advantages in multiple applications.

Cimprogetti has a wide range of equipment and plants to meet and exceed every application in lime hydration, such as water treatment, anti-stripping agent in asphalt, soil stabilization and flue gas desulphurisation (FGD).



The Hydration Process

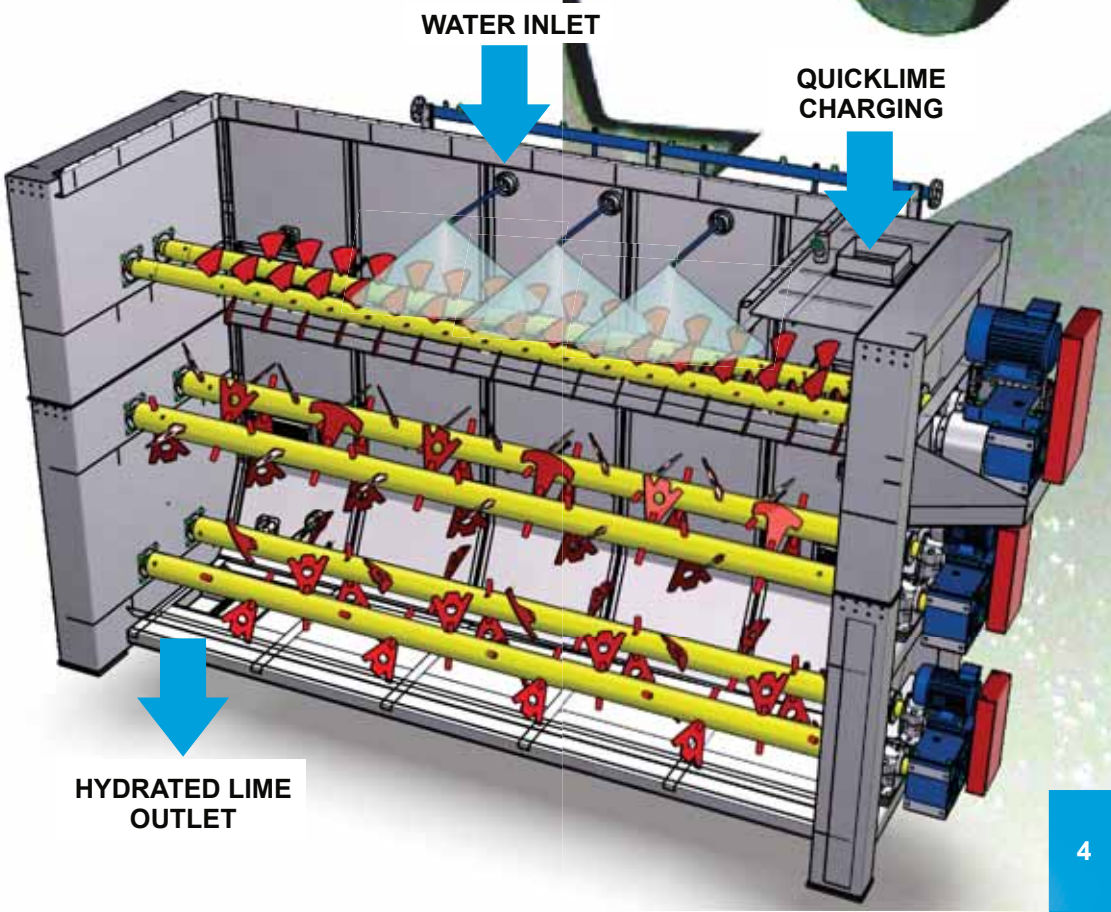
In the last century, hydrated lime was produced by filling a big pit with quicklime and water. Today, the highly exothermic reaction between lime and water must be carefully controlled in order to drive it towards the desired product quality and fineness.

The traditional 3-stages machine consists of:

- 1st stage: the reaction chamber
- 2nd stage: the mixing chamber
- 3rd stage: the seasoning chamber

In the first stage, the quicklime receives the hydration water from the water feed rack and is subject to a strong mixing action. At the end of the first stage, the lime falls into the second stage where the hydration reaction is mostly or wholly completed.
During the transformation of the calcium oxide into hydrate the apparent specific weight of the material is basically reduced to a half. For this reason, the second stage volume is twice as big as the one of the first stage.

The third stage is designed to further homogenise the finished product, or to allow an extra retention time to complete reaction for those quicklime qualities featuring medium or low reactivity.



The Hydrators Models

Many of the end uses of quicklime require mixing it with water, that is why it is important to be able to do that under strictly controlled conditions.

Cimprogetti has developed a 3-stages Cim-Hydrax series, the latest achievement in lime hydration technology:

- **Cim-Hydrax-4G**
- **Cim-Hydrax-4G MAX** for special applications
- **Cim-Pilot hydrator**

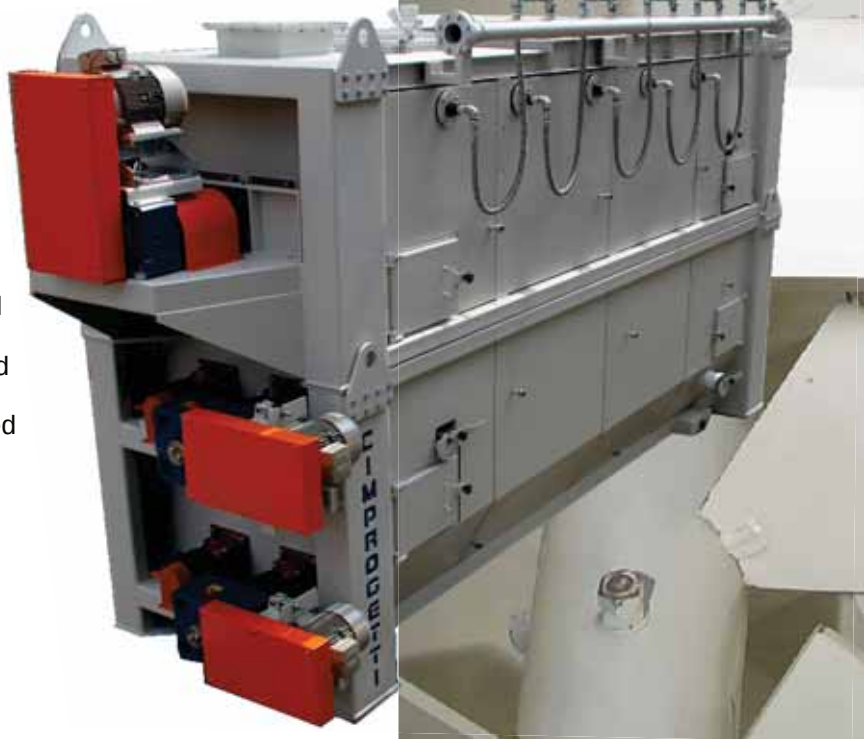
Each stage contains horizontal rotating shafts with specially designed hi-efficiency paddles to mix continuously the reacting lime and the water. Paddles have different design in the various hydrator stages for the optimum matching of their specific operational performances.

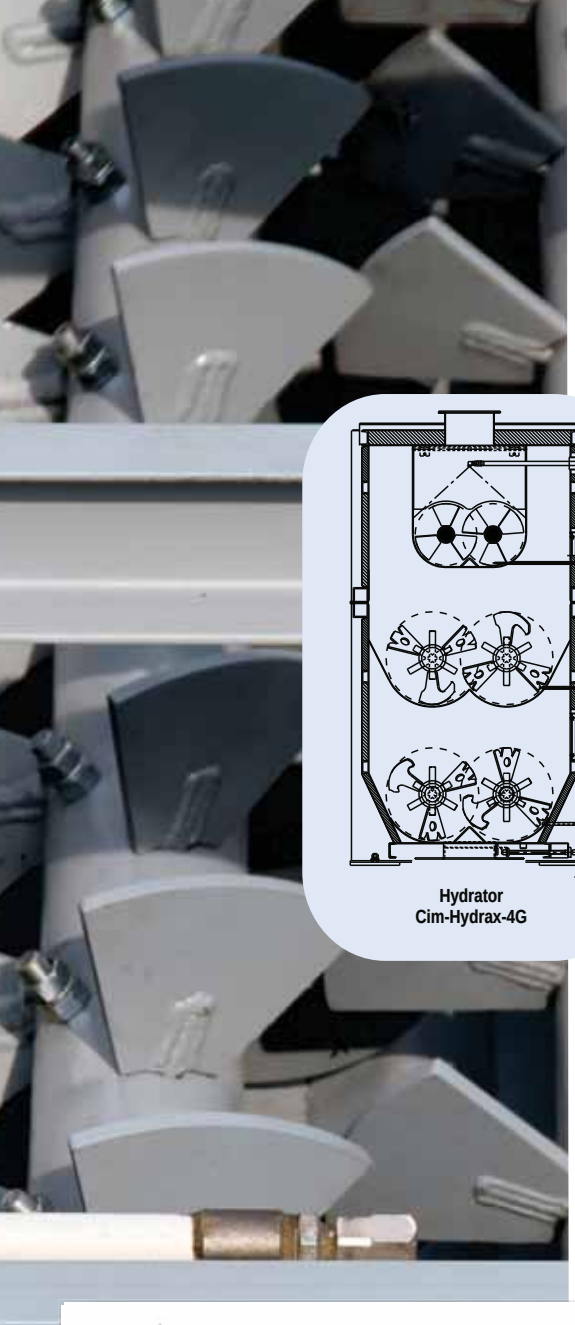
We apply our proven hydration technology to a wide range of environmental applications, including power plants, steel mills, waste to energy plant and glass industry, designing modern and compact units easily integrable like:

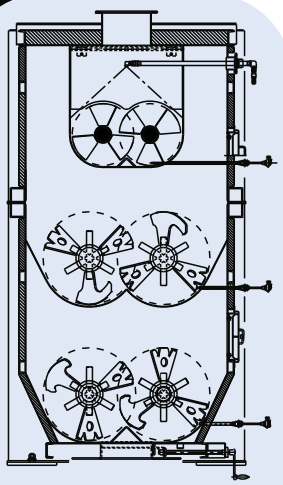
- **Cim-Hydrax-FGD**
- **Cim-Hydrax Compact®**

The basic principles which first led to the design of our Cim-Hydrax hydrators series are mainly the following:

- a compact machine capable of converting a given raw material into high quality finished products with continuous operation;
- sturdy construction, easy to operate with minimum maintenance required;
- high flexibility in terms of turn-down ratio;
- wide range of acceptable raw material qualities;
- wide range of feasible finished products;
- possibility of an automated, unmanned control;
- bespoke design.







Hydrator
Cim-Hydrax-4G

Cim-HYDRAX-4G

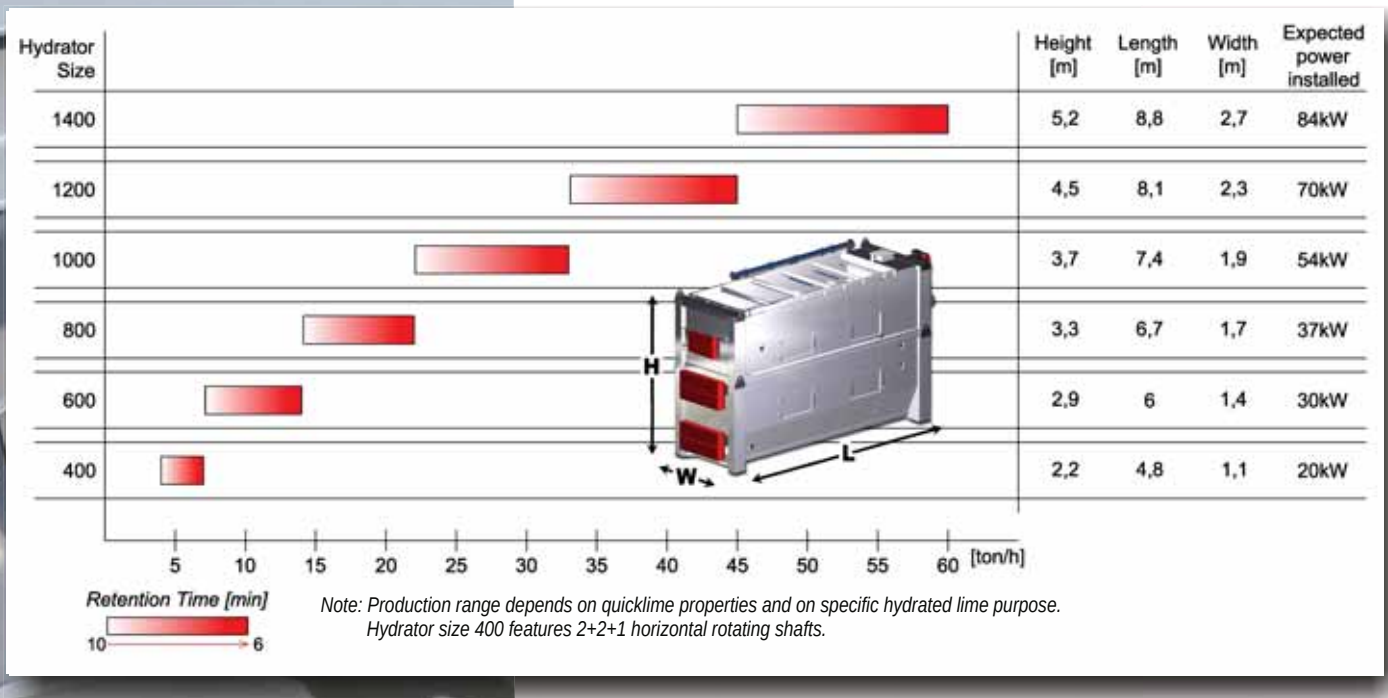
The **Cim-Hydrax-4G** hydrator is a three-stage machine with specially designed hi-efficiency paddles to mix continuously the reacting lime and the water.

Paddles have different design in the various hydrator stages for the optimum matching of their specific operational performances.

The **Cim-Hydrax-4G** series features a first stage with two high-speed shafts, equipped with an advanced multi-point water injection system for the most accurate control of the initial phase of the slaking process.

The second stage strongly mixes the material, favoring the completion of reaction in the large volume of this second chamber which is approximately the double of the first one.

The third stage vigorously ventilates the hydrated lime in order to minimize any possible light agglomeration so that the hydrate coming out of the hydrator is of enhanced fineness.



Note: Production range depends on quicklime properties and on specific hydrated lime purpose. Hydrator size 400 features 2+2+1 horizontal rotating shafts.

Hydrator Cim-Hydrax series production rates

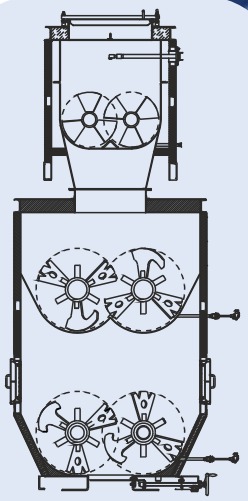
Cim-HYDRAX-4G MAX
for special applications

The **Cim-Hydrax-4G MAX** has been developed to produce specific surface of raw hydrate, in order to allow its use for a wide variety of calcium oxide.

The hydrated lime produced can reach the following characteristics:

- Standard BET hydrated lime (BET 18±2);
- Intermediate BET hydrated lime (BET ≤ 25) for standard flue gas desulphurization (FGD);
- High BET hydrated lime (BET >25) for high efficient flue gas desulphurization (FGD).

The hydrator can work in campaign producing either standard BET hydrated lime for general uses or the intermediate/high BET hydrated lime for FGD process.

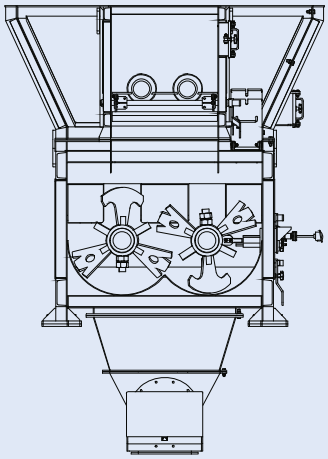


Hydrator
Cim-Hydrax-4G MAX

The production of high BET hydrated lime requires the use of chemicals. Accurate test in Cimprogetti's laboratory will be performed to define the suitable hydrator model.

Various Sorbents and their characteristics	Low BET surface	Standard hydrated lime	Intermediate high BET	High BET surface
Typical available $Ca(OH)_2$ %	92-95			
Typical surface area (m^2/g)	<15	15-20	till 25	>40
Typical pore volume (cm^3/g)	0.07 - 0.20			

Indicative values



Hydrator
Cim-Hydrax-FGD

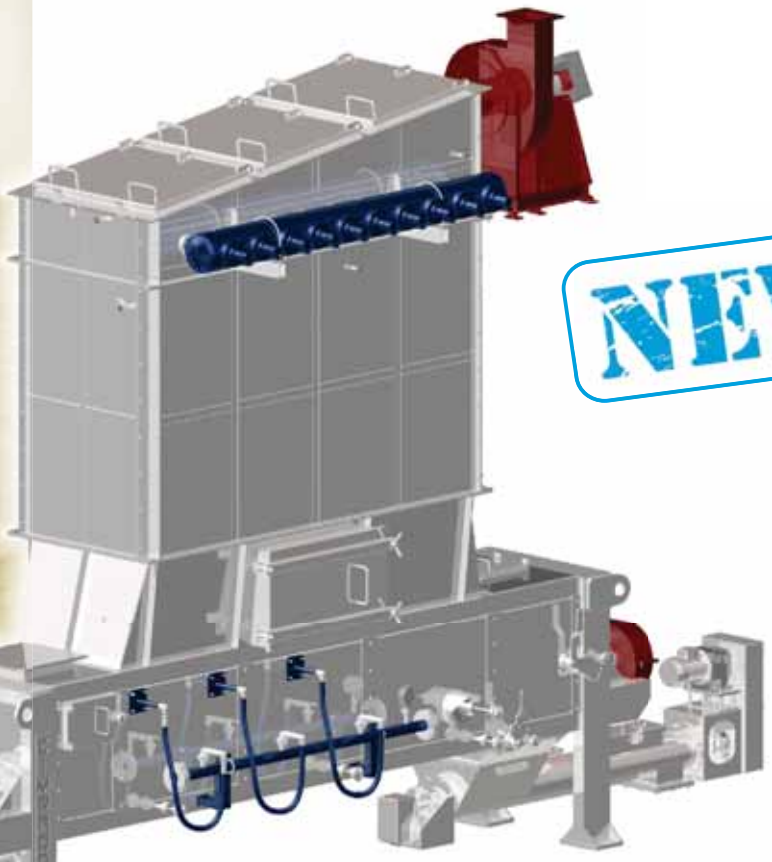
Cim-HYDRAX-FGD

All methods for the neutralization and gas purification system involve the addition of an absorbent. The most important chemisorbent for its high removal efficiency is calcium hydroxide, able to capture either sulfur and acid pollutant.

The **Cim-Hydrax-FGD** is Cimprogetti dedicated hydrator for standard flue gas desulphurization applications, when a limited quantity of product is required.

Design characteristics:

- suitable for production up to 3 tph;
- ready for automatic «in-line» operation with FGD scrubbing system;
- flexible sorbents quality production;
- reduced overall dimensions;
- easy maintenance;
- plug&play unit.



Cim-PILOT hydrator

Cimprogetti's lime hydration technology is based on close tracking of process conditions.

The **Cim-Pilot hydrator** is a scale down of our standard hydrating machine able to execute very effective testing campaignes at clients' plants sites.

The results of the tests are effectively used for the design and supply of the industrial scale hydrator which is best matching the client objectives.

Technical features:

- production: up to 130 kg/h
- dimensions: L3800x660xH3850 mm
  (including feeding & discharge screw conveyor and bag filter)
- electric board dim.: 800x600x2100 mm
- installed power: 5 kW
- total weight: 1600 kg *(including eletric board)*

The **Cim-Pilot hydrator** is made available on a rental basis to be defined - Client to provide raw material and utilities.

HIGH-EFFICIENCY SEPARATION TOWER CIM-MICROBLOC

The Cim-Microbloc is an integrated tower, which has been designed to combine the highest separation efficiency with a compact, stand-alone unit which fits all auxiliary components for the separator process.

Flexible layout, simple plant arrangement, the separation tower concept is very suitable for the revamping of existing plants.

Main features:

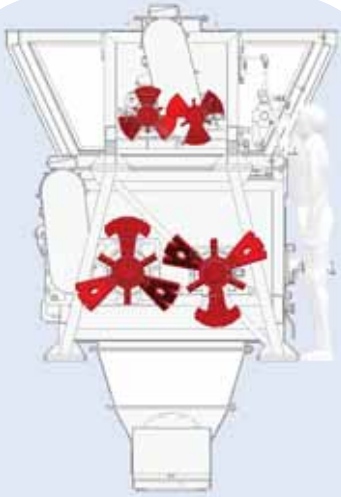
The separation tower responds to the demand for a cost effective upgrading of existing hydration units:

- Reduce to the minimum the downtime of the plant during the upgrade works;
- The tower is installed and put on-stream in a few days as it requires minimal interfacing works with the plant;
- Installation is eased by the Cim-Microbloc total mechanical and electrical shop pre-assembly.

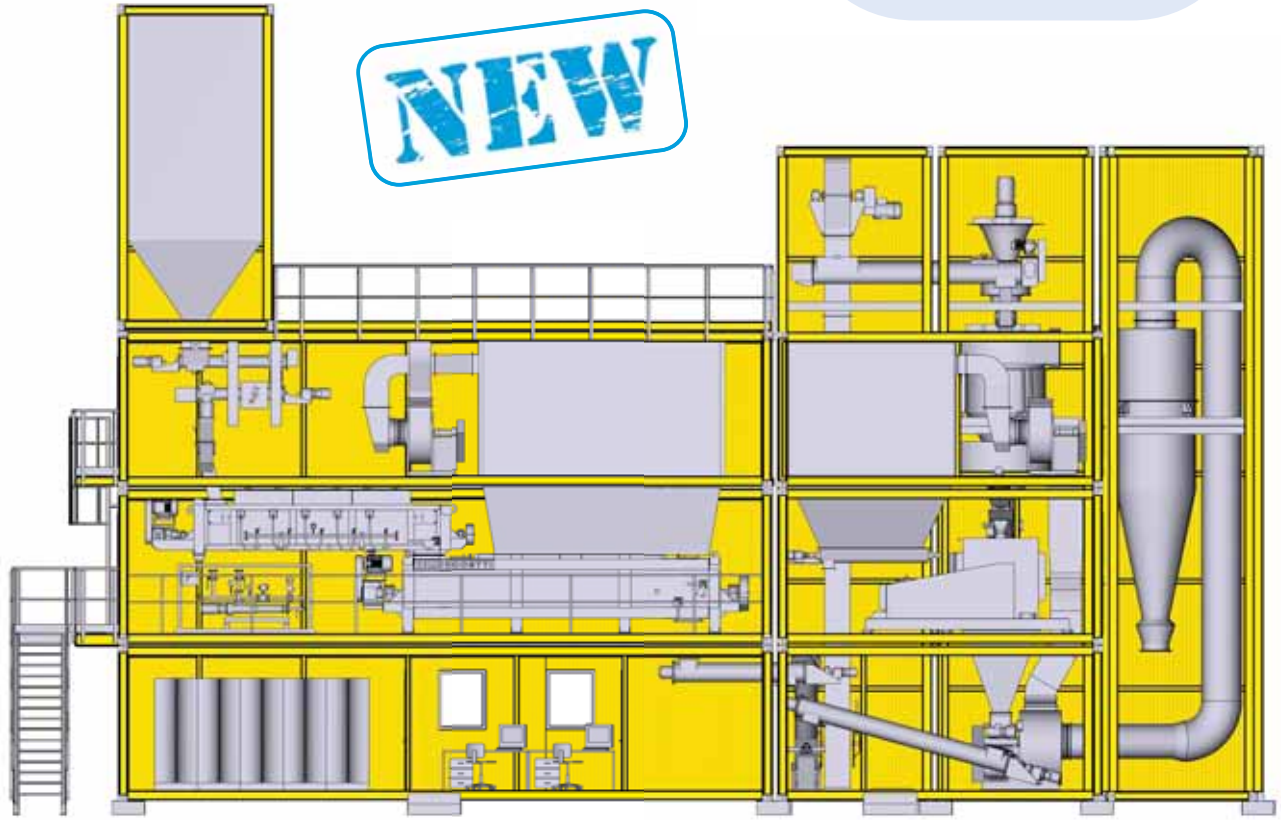
The Cim-Hydrax-Compact®

Bespoke design for Industrial hydration plant aimed to:

- reduce the overall dimensions,
- be as compact as possible by eliminating unnecessary auxiliary machines and spaces,
- reduce the CAPEX,
- preserve contractual performances of the Hydrax.



Hydrator
Cim-Hydrax-Compact



The Cim-Hydrax-Compact® is a complete and autonomous hydration plant, suitable for production up to 10 tph, based on a compact conventional process: CaO hydration, separation, grinding.

As a result of the modular design, the compact configuration allows the installation of the hydration plant directly in the production facility within a minimal footprint. The plant can be easily adapted and modified based on new operational needs. Cim-Hydrax-Compact® is a real cost effective/short lead-time solution.

CIM-ZEROPOLL™
technical data

Dust content at the chimney outlet : <10 mg/Nm^3

Main features

- Filtering chamber in structural steel sheets in which the filtering bags, supported by cages, are placed;
- self-supporting structure with connection chute to the hydrator;
- air-tight inspection doors;
- pulse-jet bag cleaning devices with automatic cleaning cycle;
- thermal insulation of the lateral walls and of the top in order to reduce incrustations of material;
- ID centrifugal fan, motor driven by VSD.

The advantages of the filter CIM-ZEROPOLL, if compared with the traditional wet scrubbers, are mainly:

- low dust content at the chimney outlet;
- reduced maintenance;
- full automation possible;
- more control on the heat released from the reaction.

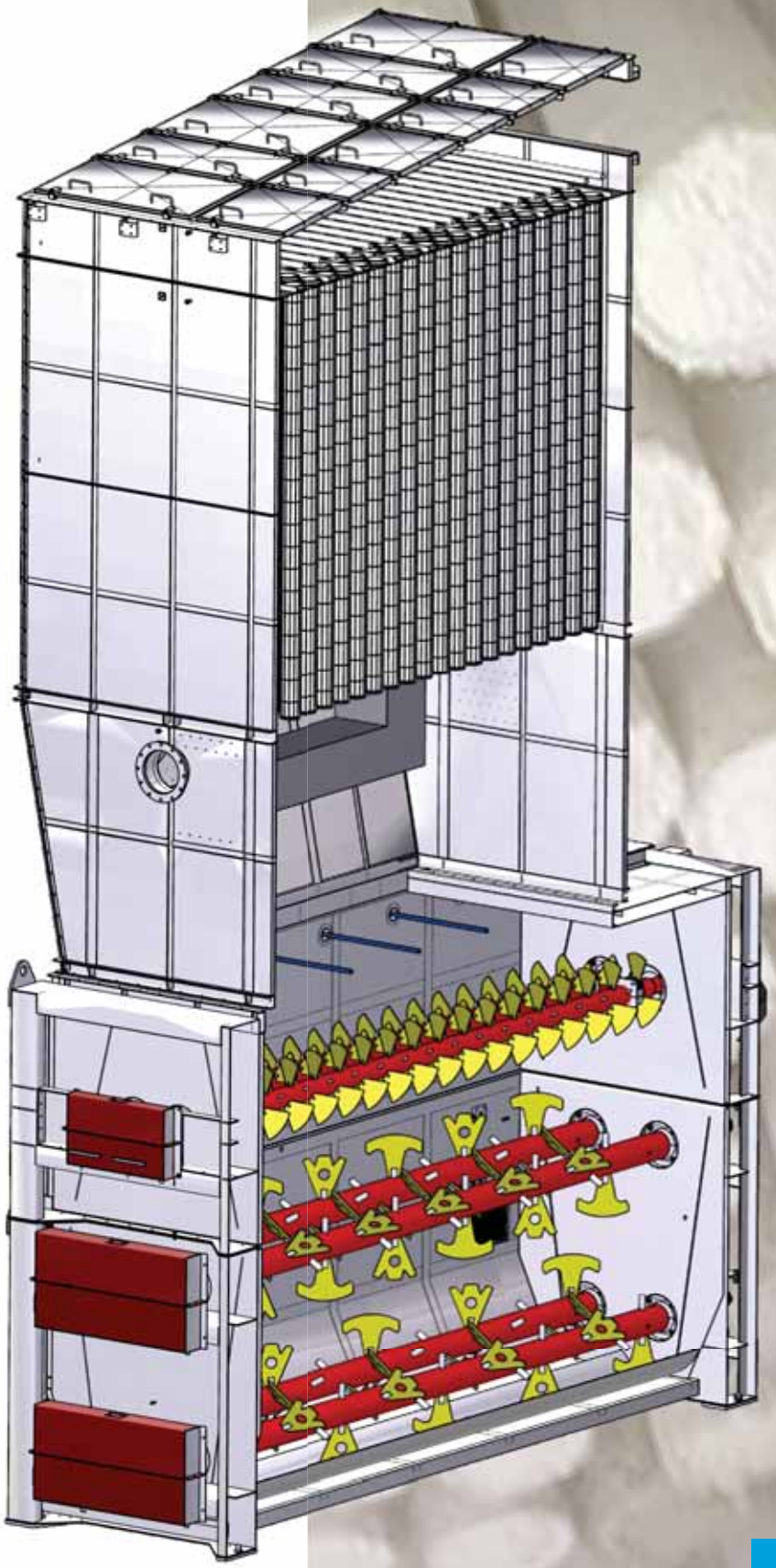
The Cim-Zeropoll filter

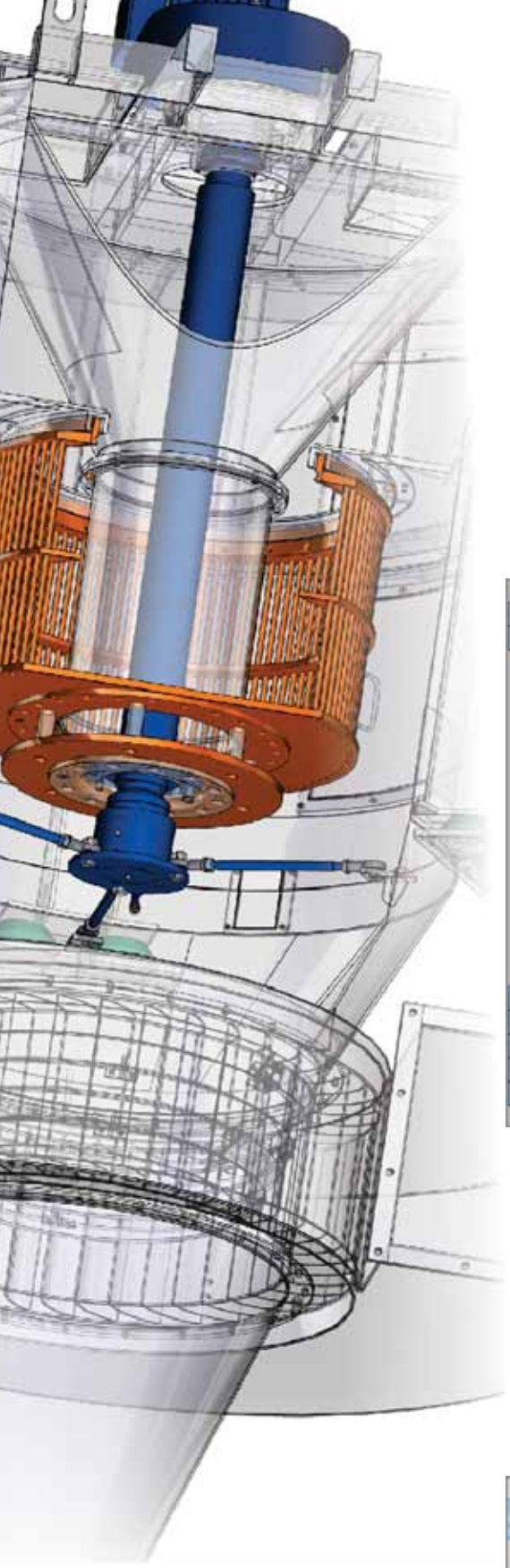
The Cim-Zeropoll is the dedicated bag filter for hydrators dedusting. It is based on the well proven pulse-jet cleaning effect. This device represents the most modern pollution control system and it is complying to the most stringent Air Quality standards with the lowest dust emission content at the stack.

The bag filter is located on the top of the hydrator as a result of extensive studies and industrial experiences. The filtering area selection and operation parameters are also the result of several years of testing to determine the right air to cloth ratio and the most suitable fabric for the bags, featuring good value for money and extended operation life.

The ID fan is controlled by a frequency converter, to adapt the filter operation to the variable flow of steam that the hydrator may generate in different operating conditions.

The Cim-Zeropoll can also be installed on any hydrator supplied by thrid parties.

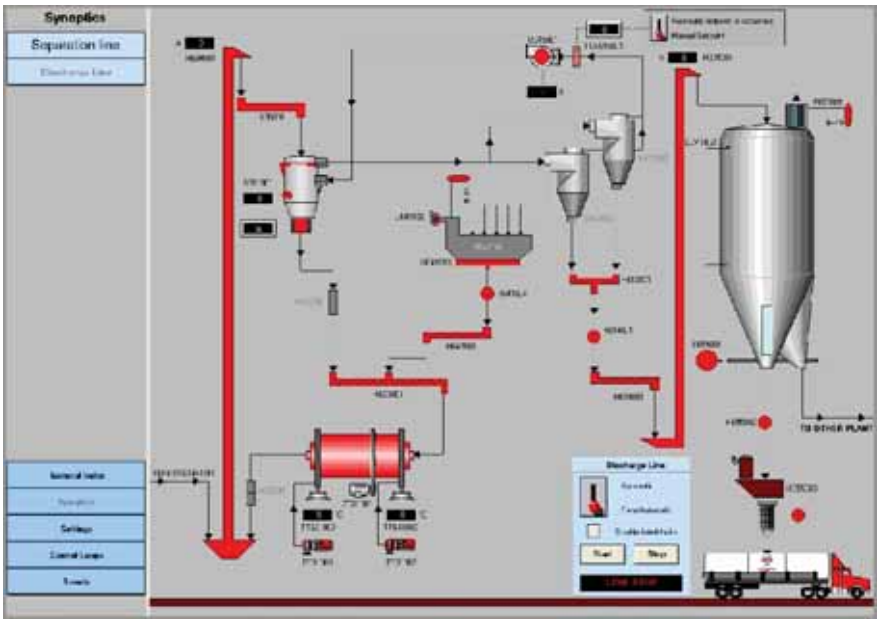




The Cim-Microsep Separator

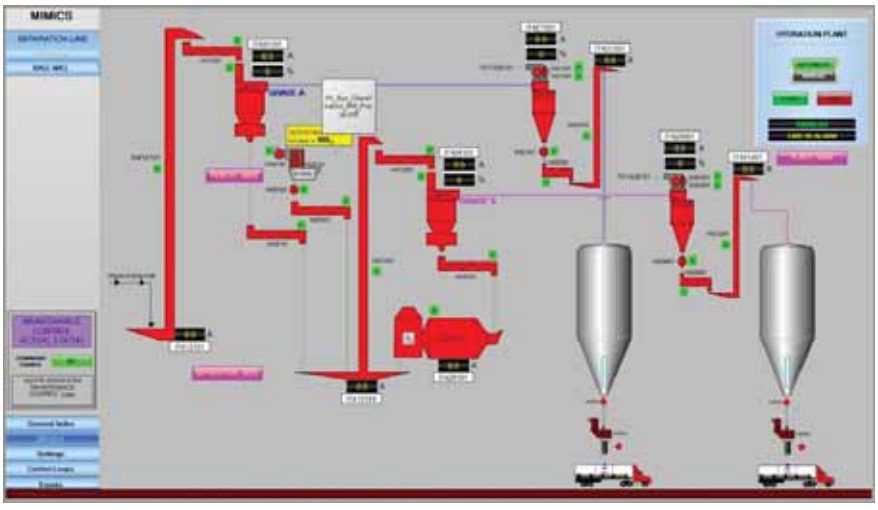
Plant configurations with the Cim-Microsep separator:

- **CIM-MICROCLON concept**



- Two separation circuits **CIM-MICROSEP plus CIM-MICROCLON** for contemporary production of no.2 hydrate grades

  The two sequential separation circuits enable the contemporary production of a 1st grade with higher $Ca(OH)_2$ content (called “chemical grade”) and of a 2nd grade (called “building grade”).
  The remarkable production flexibility by adjusting the ratio of production of 1st grade vs. 2nd grade allow to meet the market demand.

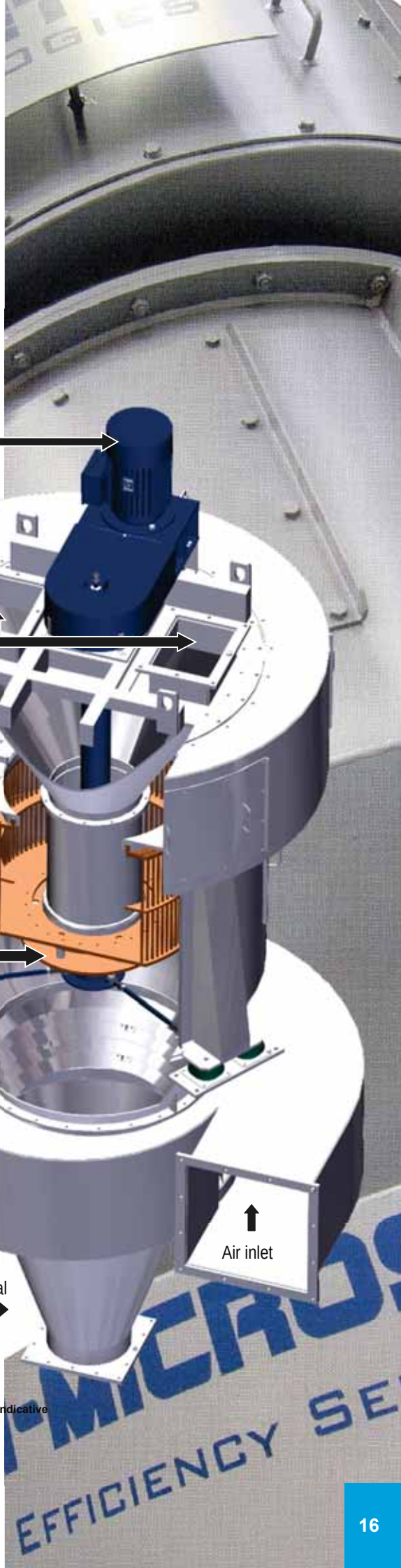


The Cim-Microsep separator is designed to ensure maximum efficiency & quality control of the end-product.

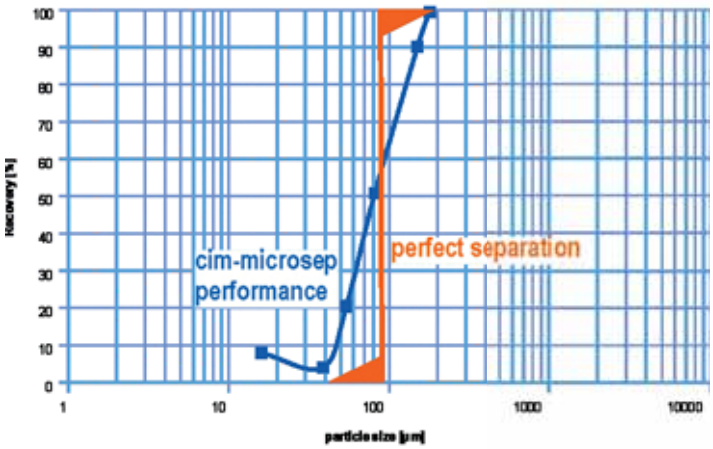
The separator is highly adaptable to different fineness requirements of the product, thanks to the wide range and combination of regulations applicable to the rotation speed of the selection cage and to the air flow.

Pressure sensors in the circuit and selection cage speed control assure a smooth and stable running of the separator.

The raw material entering through the feed inlets is subject to centrifugal force, which uniformly distributes the material within the air stream. The ascending air flow pushes the material towards the multi-blade selecting cage. The fines are then exhausted into the system collector, while the coarse material is discharged by gravitational force through a cone for further processing.



Separation curve (Tromp curve)



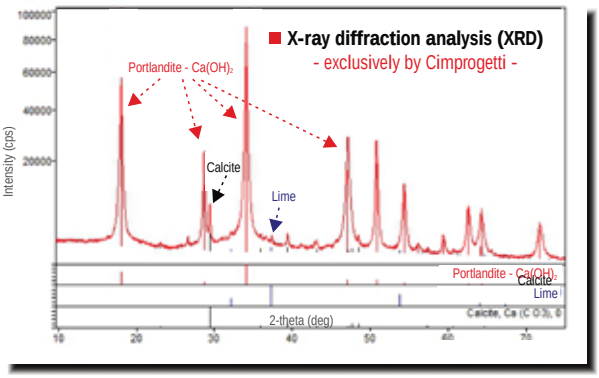
Material : ground limestone / Cutsize : 30 microns
Global by-pass : 6% / Maximum by-pass : 10%

Hydrated lime

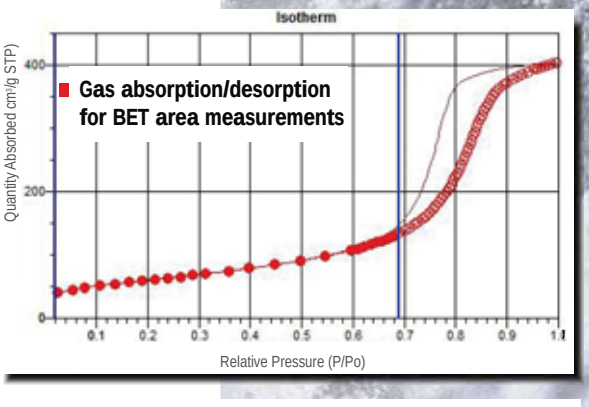
Quality control in LAB

Lime products with different BET surface areas are required by different end users, depending on industrial applications.
In order to fullfil the specific demand of various quality hydrated lime, Cimprogetti is spurring the development of its unique scientific laboratory through the use of modern equipment, conducting rigorous research and solving challenges for client worldwide.

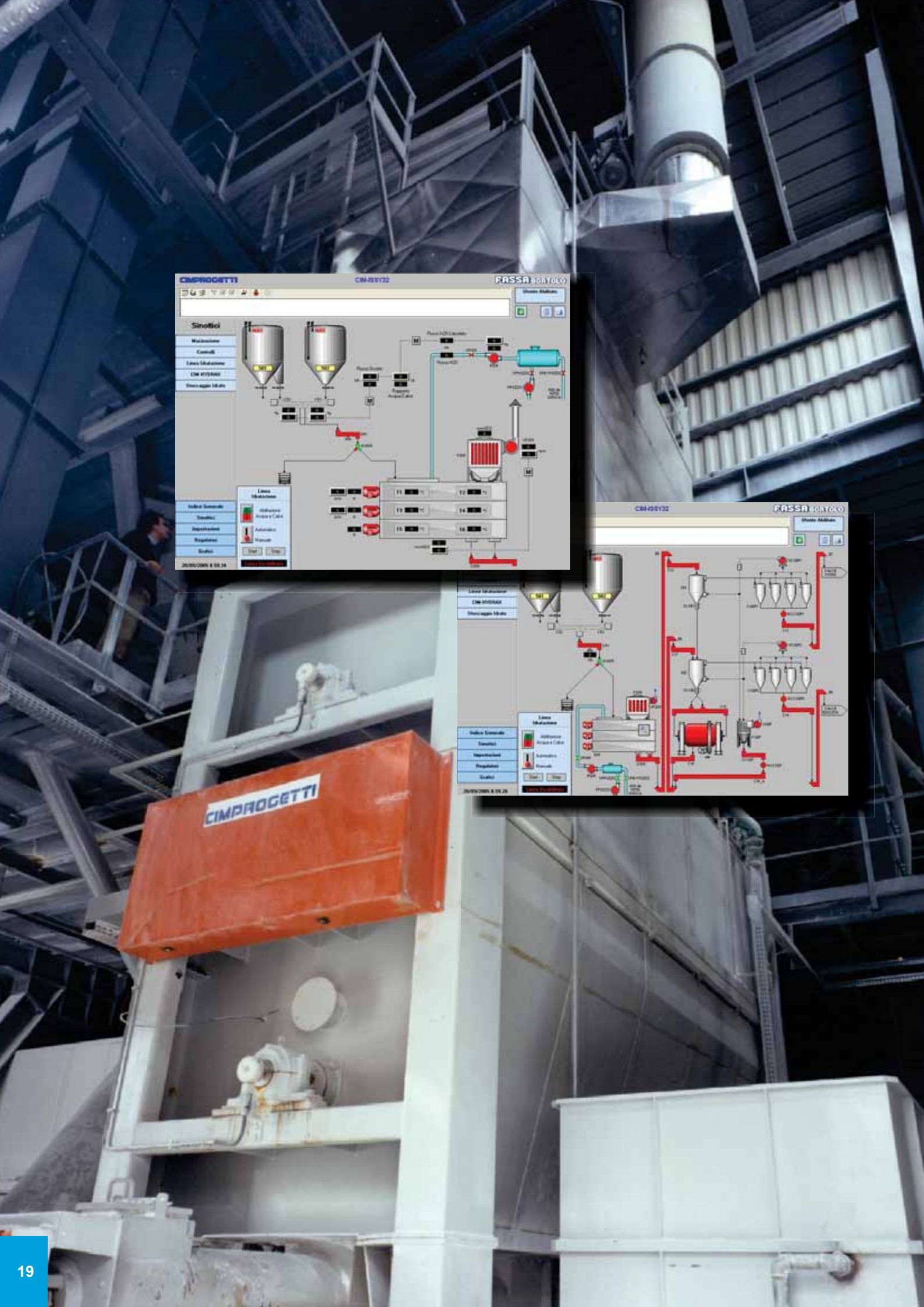
Characteristics	Standard Low	Standard	«intermediate» High	High
BET areas	<15 m^2/g	15-20 m^2/g	till 25 m^2/g	>40 m^2/g
Hydration Techniques	Standard Hydration	Standard Hydration & Double Hydration technique	Pre-Hydration Post-Drying High residual moisture technique	Chemicals (admixtures) Hydration
Industrial Applications	General Purposes	FGD	FGD	Sulphur, Chlorine and Fluorine removal (dry process)



Typical determination of the elemental composition executed by Quantitative Phase Analysis by Rietveld method - example



Brunauer-Emmet-Teller (BET) determination for the measurement of the specific area of different hydrated lime


CIMPROGETTI
FASSA BORTOLO
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CIMPROGETTI

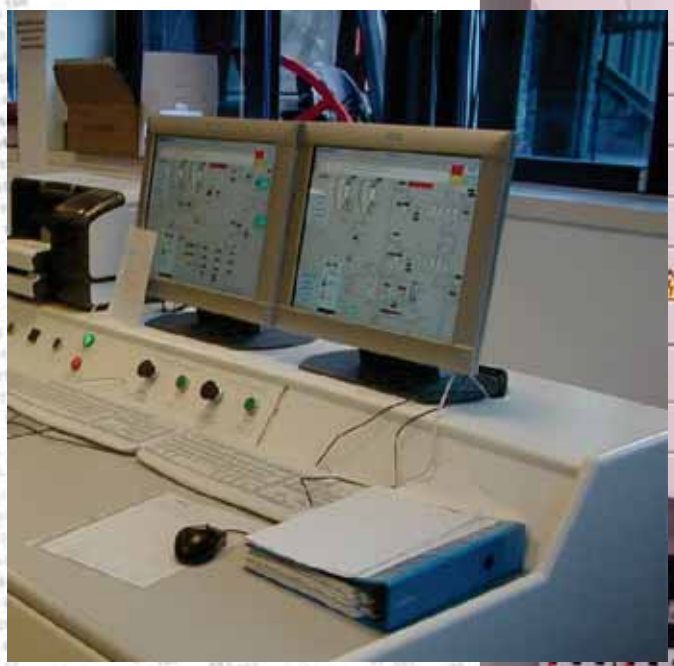
The Control System

Having always been sensitive to technical innovation and striving to add value to its plants, Cimprogetti has studied, designed and realized its own control system, named **CIM-LPCS®**, which is continuously updated on the basis of the experience gained in the design and commissioning kilns worldwide.

Designed for industrial environments, where the security of data and personnel is a primary issue, the control system manages the process by tracking the data and functions of plant operation while keeping its user friendly characteristics.

Last but not least, remote data transfer and analysis of operation, alarm management as well as on line scheduled maintenance support, are only but a few of the standard features of the Cimprogetti control package.

Cimprogetti control system is the only software of the lime experts.



SURPLUS VALUE TO YOUR ACQUISITION

AFTERMARKET SERVICES

«Italians do it better ...»

One of the main needs for an industrial production Company is the guarantee to have a continuous and remote technical support directly from the supplier, after the plant start-up.
To achieve the **excellence** of equipment and plant operation, Cimprogetti has developed a superb **worldwide service and support** system for its state-of-the-art facilities..

INTERNATIONAL NETWORK OF DEDICATED ENGINEERS

No matter where you are located on the globe, we can **rapidly** supply a reliable technical support on site.

SPARE PARTS

Cimprogetti promptly allocates spare parts all over the world.

SUPERVISION SYSTEM CIM-LPCS®

The **CIM-LPCS®** Supervision System oversees the traditional management of the plant while taking into account data from interconnection with the Customer's information system.

CIM-NAVIGATOR® for the control, monitoring and analysis of the plant operation;

CIM-ASSISTANCE® for the maintenance / modifications of the plant control system and for the identification of breakdowns or damages;

CIM-WATCH® for consulting process states with a web or mobile interface.

EDUCATION & TRAINING

Process operator training is essential for the safety operation of plant facilities.
IN OUR HEADQUARTERS, SKILLED INSTRUCTORS DELIVER TRAINING COURSES AND SEMINARS FOR OPERATORS AND PRODUCTION SUPERVISORS.
Fifty years of experience and knowledge at disposal of our Customer to obtain a certified process operators training program...

Lime Technologies
Since 1967

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